Release 4.2

Model Methodology

Loop Module
(Book II of VII)

Verizon

ICM MODEL METHODOLOGY PACKAGE

➢ Conceptual Framework	Book I
➢ **Loop Module**	**Book II**
➢ Switch Module	Book III
➢ Interoffice Transport Module	Book IV
➢ SS7 Module	Book V
➢ Expense Module	Book VI
➢ Mapping/Report Module	Book VII

EXPLANATORY NOTE

In the following documentation, “Verizon” is used to refer to the former GTE Corporation and its operations which are now part of Verizon Communications along with the former Bell Atlantic Corporation.

Table of Contents

INTRODUCTION

Local Loop

The Loop Module is designed to develop investments for local loops that are capable of providing advanced digital services. These loops can be used for single-line residential and business services, Key lines, PBX trunks, Centranet lines, as well as Integrated Service Digital Network (ISDN) and Asymmetric Digital Subscriber Line (ADSL). The module develops volume sensitive and volume insensitive investments for each of the loop components between the protector at the customer's premises and the main distribution frame in the central office (see Appendix D).

A table containing component names and related investments developed by the Loop Module is exported to the Mapping Module (refer to Book VII in the Integrated Cost Model (ICM) Methodology package for details[1]). In the Mapping Module, product and services costs are developed based on inputs from other modules, and cost definitions provided by the user. These cost definitions establish how the components developed in the Loop, Expense, Interoffice Transport and Switch modules are to be assembled into product and services.

Summary Of Features

At the core of ICM 4.2 are a pair of primary algorithms that allow the loop module to dynamically determine the location of pair gain devices, the network connecting those devices to the wire center, and the cells within the Electronic Serving Area (ESA). An ESA is an area in which all customers have access to a loop capable of providing digital services. The first algorithm is a K-mean clustering algorithm. The second algorithm is a constrained Minimum Spanning Tree (CMST) algorithm. These two algorithms permit the rapid development of detailed network investments.

Supporting the primary algorithms are a set of detailed engineering assumptions and user inputs that permit the user to determine, on a step-by-step basis, how each investment item is calculated and to perform sensitivity analysis at each stage.

Even with all of the additional detail that has been built into ICM 4.2, reasonable run-time still remains one of the key features that was common to

[1] The ICM Methodology package is divided into seven booklets: Conceptual Framework (Book I); Loop Module (Book II); Switch Module (Book III); Interoffice Transport Module (Book IV); SS7 Module (Book V); Expense Module (Book VI); and Mapping/Report Module (Book VII).

earlier versions. To facilitate the sensitivity analysis permitted by relatively quick run-times, a graphical interface allows the user to view the network being developed as well as to analyze the output. The basic flow chart below gives an overview of the general modeling approach and shows how investments for loop components are developed.

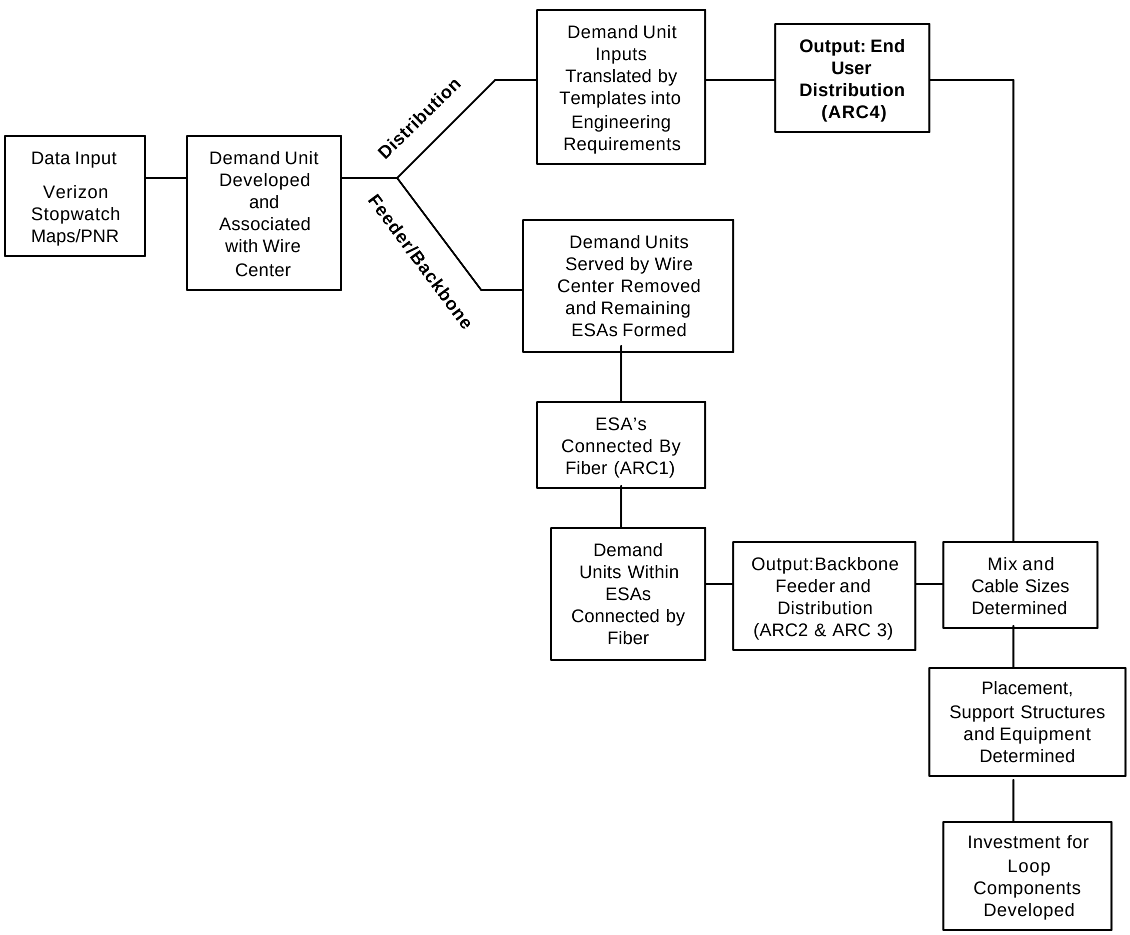


Figure 1: Loop Module Flow Chart

MODEL METHODOLOGY

Loop Module Design

The foundation of the ICM 4.2 Loop Module is based on four items. These items ensure that the Loop Module is sensitive to the demand characteristics of each area being modeled, and that the results of the module accurately estimate the cost of providing service. The four items are: uniform demand units, an Electronic Serving Area (ESA) development, a local loop network design, and detailed engineering at all levels.

The **Uniform Demand Unit** is a standard $1/200^{th}$ degree by $1/200^{th}$ degree area that contains detailed demand, infrastructure, and topographical information needed to accurately design a telephone network. The unit, depending on latitude, encompasses an area of roughly 1500-by-1800-foot or about 60 acres.

The next item is the Loop Module's **Electronic Serving Area (ESA)** development. An ESA is an area in which all customers have access to a loop capable of providing digital services. The K-mean clustering algorithm was chosen as the mechanism for developing ESAs because of its speed, flexibility, and ease of understanding how the results were developed.

The third item is the Loop Module's **Local Loop Network Design.** ICM uses a Constrained Minimum Spanning Tree (CMST) Algorithm patterned after the Spanning Tree routine used by the Federal Communication Commission's (FCC's) Hybrid Cost Proxy Model (HCPM). This algorithm is used to develop the feeder network connecting the pair gain devices and the backbone network that connects the demand units within a cluster. Templates define the distribution network within a demand unit.

The final item is the **Detailed Engineering** contained in the Loop Module. ICM uses a variety of detailed engineering procedures to provide logical determinations of network characteristics such as structure type and size, placement type, material types and sizes, and labor costs.

Uniform Demand Unit

The uniform demand unit is a standard $1/200^{th}$ degree by $1/200^{th}$ degree area. Although the basic demand unit is not a standard size in the sense of physical area, it is standard in terms of degrees. This is a very important feature because it precisely locates the area being examined. A demand unit contains residential and business line counts, road-feet, and topographical conditions such as a bedrock depth, and water table depth. All of the data mapped to the demand units are based on publicly available information.

The 1/200th degree demand unit is a fundamental building block of ICM. The unit is developed to represent a logical square of the earth's surface. The latitude and longitude of its center point or centroid[2] identify each demand unit. The unit, measured in latitude and longitude, and consisting of a standard size measure in degrees, is a natural way of further dividing up the coordinate system imposed on the surface of the earth. In the actual demand unit record found in the model, coordinates that indicate the position of each demand unit relative to the wire center have replaced the latitude and longitude. A value of (0,0) would indicate that the wire center is contained within the demand unit; a value of (1,0) – where the X coordinate is 1 and the Y coordinate is 0 – would indicate that the demand unit is immediately adjacent and to the right of the demand unit containing the wire center.

The demand unit, besides being a standard 1/200th degree by 1/200th degree area on a map, is also a record in the Demand Table with each column of the table containing information such as CLLI, road length, water table depth, access lines etc. (See Appendix A for additional fields). When a demand unit is viewed as a record it gives a clear picture of how the information populating it is developed and what are the sources of the data.

The following sections present a step-by-step process through which each field or column in the demand unit record is populated. The description of this process begins with the data sources of a demand unit record and finishes with a description of the process by which the record is populated.

SOURCES OF DEMAND UNIT RECORD

Road, terrain and line count information is used to develop customer location data and to reflect conditions that impact the cost of service. The road information comes from the US Census Bureau's Topologically Integrated Geographic Encoding and Reference (TIGER) files, and the terrain data comes from US Department of Agriculture's State Soil Geographic (STATSGO) database. PNR Associates provides estimates of business and residential line count data at the census block level developed from US Census data.

Stopwatch Maps compiles the line count data from PNR Associates, the road (TIGER files) data from US Census Bureau and the terrain data (STATSGO) from US Department of Agriculture, and processes the data to produce a text demand file (for details see Appendix B). The processing of the data involves taking the terrain and road data and distributing it along with the information provided by PNR Associates to the demand units using MapInfo[3]. This same package is used to associate the demand units with the appropriate tariff boundary and wire center. MapInfo allows the data that have been collected

[2] The centroid is labeled with latitude in the form dd.dd25 and a longitude in the form –[d]dd.dd25, where d represents a decimal digit such as the 2 and 5 in the third and fourth decimal places. Since the latitude and longitudes of the demand units will end in either 'dd0' or 'dd5', the midpoint will end with either a value of 25 or a value of 75.

[3] Map Info is a sophisticated Geographic Information System (GIS) software package.

by Census Block or Census Block Group, (which are highly irregular in size and shape), to be accurately mapped to the standard 1/200th degree demand units.

PROCESSING OF DEMAND UNIT RECORD

Assignment Of Demand Units To Switches

Verizon's tariff boundaries for each wire center are overlaid upon the demand unit network (Figure 2), using MapInfo, and only those demand units whose centroid falls within a Verizon tariff boundary are included in the modeling process.

The example below demonstrates that although 144 demand units fall within, or otherwise intersect, this particular tariff boundary, only 114 of the demand unit centroids fall within its boundary and will be assigned to a switch within the boundary.

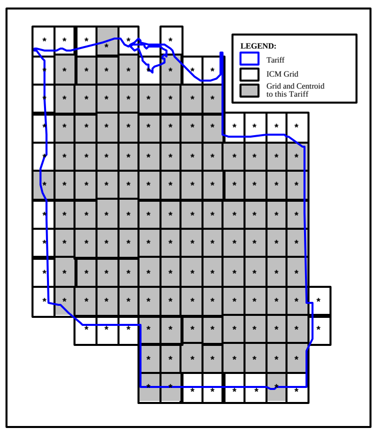


Figure 2: Demand Unit Assignment

The demand unit assignment process begins with Verizon providing Stopwatch Maps a set of two tables, one containing digitized wire center boundaries and the other containing the set of switches identified by the Common Language Location Identifier (CLLI) code and Latitude and Longitude.

Development Of Coordinates

The X and Y coordinates of the wire center are (0,0). The remaining coordinates are developed relative to the wire center/central office.

The X coordinate is the horizontal location from the wire center/central office of a demand unit. A positive number indicates that a demand unit is that many units to the right of the central office. A negative number indicates that a demand unit is that many units to the left of the central office. A zero coordinate would indicate that it is directly above or below the central office depending on the Y coordinate's value. The Y coordinate is the vertical location from the central office of a demand unit. A positive number indicates that a demand unit is that many units above the central office. A zero value indicates that it is directly to the left or right of the central office depending on the X coordinate's value.

Road Length Identification Data Development Based On TIGER Files

The total road length within a demand unit is used to characterize the infrastructure development that has taken place within it and serves as the basis for the development of the distribution investments associated with the unit.

The type of roads assigned to the individual demand units consists of roads along which housing or business development would normally occur and from which the customer would have access to their premises. Excluded road types include interstate highways, limited access roads, bridges, tunnels, and access ramps. Also excluded are segments such as alleys, driveways, and motorcycle trails. Driveways and alleys are excluded because they are typically associated with premises that can be reached with one of the types of road already included. Motorcycle trails are excluded because one does not typically find residential housing or businesses located along them.

The mapping of roads to demand units involves overlaying, in MapInfo, the demand unit table onto the digitized data from the Topologically Integrated Geographic Encoding and Reference (TIGER) files and calculating the total length of the segments that fall into each of the demand units. Where a segment runs through more than one demand unit, the segment is assigned proportionally to each affected demand unit. For instance, if twenty-five percent of a segment falls in Demand Unit A and seventy-five percent falls in Demand Unit B, then twenty-five percent of the segment will get assigned to Demand Unit A and seventy-five percent of the segment will get assigned to Demand Unit B. This process of assigning road length takes into account both curved and straight segments.

Assignment Of Terrain Data To Demand Unit

The *State Terrain,* a digitized census block group level data set, used by Stopwatch Maps was derived from the STATSGO data. Stopwatch Maps assigns terrain data to demand units by determining which census block group (CBG) contains a demand unit's centroid. The terrain characteristics of the CBG containing that point is assigned to the corresponding demand unit. The assignment of this data, in conjunction with the road feet data, determines the character, and, for the purposes of ICM, the *style* of a demand unit.

ICM considers two terrain elements that specifically impact the cost of providing telephone service – bedrock depth, and water table depth. Bedrock depth indicates the average minimum depth of bedrock rounded to the nearest whole number of inches. Water-table depth, similar to bedrock depth, identifies the average minimum depth of the water table in inches rounded to the nearest whole number. A more detailed description of the process is provided in Appendix B.

Line Count Development Based On Data From PNR Associates

PNR Associates, using their Access Line Model, develops the basic business and residential line counts at the Census Block level. The model uses survey information, the Dun & Bradstreet database, the Donnelley Marketing household database and Claritas 1995 census estimates, based on the 1990 Census, to estimate the number of residential and business access lines in each Census Block in the United States. Stopwatch Maps takes the information developed by PNR Associates and maps it to the demand unit using MapInfo.

The process of mapping demand quantities is road-based rather than area-based, and begins by determining for each demand unit the road segments and portions of road segments that belong to each Census Block overlaid by the demand unit. A set of allocation factors is then developed for each Census Block, with each factor corresponding to one of the demand units overlaying the Census Block. The allocation factors, which sum to one for each Census Block, are the ratio of road feet from the Census Block in the demand unit to the total road feet in the Census Block.

Once the allocation factors have been developed for each of the Census Blocks, they are used to assign the residential and business lines to the demand units. The resulting line counts in a unit is the sum, across all of the Census Blocks that the demand unit covers, of the allocation factors times the residential and business line counts. This allocation process produces the raw demand unit data that are then reconciled to match the total available from Verizon's internal records at the wirecenter level which, when totaled, yield ARMIS equivalent lines at the State level. This reconciliation is done for both residential and business lines separately and involves scaling the line counts for the demand units so that their total exactly matches that of the wire center.

Electronic Serving Area (ESA) Development

An Electronic Serving Area (ESA) is an area in which all customers have access to a loop capable of providing digital services. The size of an ESA is determined by the maximum copper loop length (in combination with cable gauge) that allows for the satisfactory transmission of pre-determined digital data rates and acceptable analog voice levels.

ICM 4.2 provides the user the flexibility to develop loop cost based on three types of networks which will result in two ESA sizes due to different loop lengths. The first type provides a network capable of providing 6Mbit digital transmission to all customers by developing ESAs (clusters) with maximum copper loops of 12,000 feet and by provisioning the loops with 24 gauge cable. The second design also develops ESAs with maximum copper loops of 12,000 feet but, because it designs loops with 26 gauge cable, it provides loops with limited bandwidth capability. The third network develops ESAs with a maximum copper loop length of 18,000 feet and provisions the loops with 24 gauge cable. It also utilizes DLC extended loop cards for the longer loops requiring additional gain[4]. Bandwidth capability is limited as well in this scenario due to the longer loop length.

Electronic Serving Areas are developed in ICM using a K-mean clustering routine. Clustering algorithms, which are typically used in marketing research, are commonly used for grouping observations and pattern recognition.

The K-mean methodology starts with a known number of clusters and focuses on determining the members of those clusters. The number of clusters to be used and the initial start points must be determined outside of the K-mean algorithm. Once given these values, the algorithm will cycle through a series of steps involving assignment of observations to clusters and recalculation of means (i.e. centers of clusters). During the assignment process any observation is free to shift from one cluster to another. The process will stop when all observations are associated with the cluster center closest to them.

ICM's use of the K-mean algorithm increases or decreases the number of clusters in order to insure that the copper loop length restriction is sufficiently satisfied, and to insure that the initial number of clusters has not been set too high. A more detailed description of how ICM uses the K-Mean algorithm is presented in Appendix E.

Local Loop Network Design

The ICM 4.2 network consists of two basic components: Feeder network and Distribution network. Each of these networks is further sub-divided into two components, as described below.

Headings	Description
Feeder Network	Fiber Feeder
	Copper Backbone Feeder
Distribution Network	Local Distribution (Copper based)
	Copper Backbone Distribution

The ICM 4.2 feeder network is sub-divided into the fiber feeder and copper backbone feeder. The fiber feeder connects the wire center to all Digital Loop Carriers (DLCs) in an ESA. The copper backbone feeder connects the DLCs (in non-core clusters)[5] or the wire center switch (in the core cluster) to the cross connect boxes (SAIs) in each of the four directions.

[4] Loops served by DLCs that extend greater than 16 kft from the DLC require extended loop cards.

[5] The cluster that is fed on a physical basis from the central office is referred to as the "core" area. Clusters that are fed from Digital Loop Carriers (DLCs) are referred to as being in the "non-core" area.

The two components of ICM 4.2's Distribution network are the backbone distribution and local distribution. Both these components are copper-based. The backbone distribution connects the SAI to the local distribution portion of the network. The local distribution network completes the loop, extending from the copper backbone distribution cable to the customer. If a cross connect box is not required in the route, the copper backbone distribution connects directly to the local distribution network, eliminating the need for backbone feeder cable (refer to Figure 3 for details).

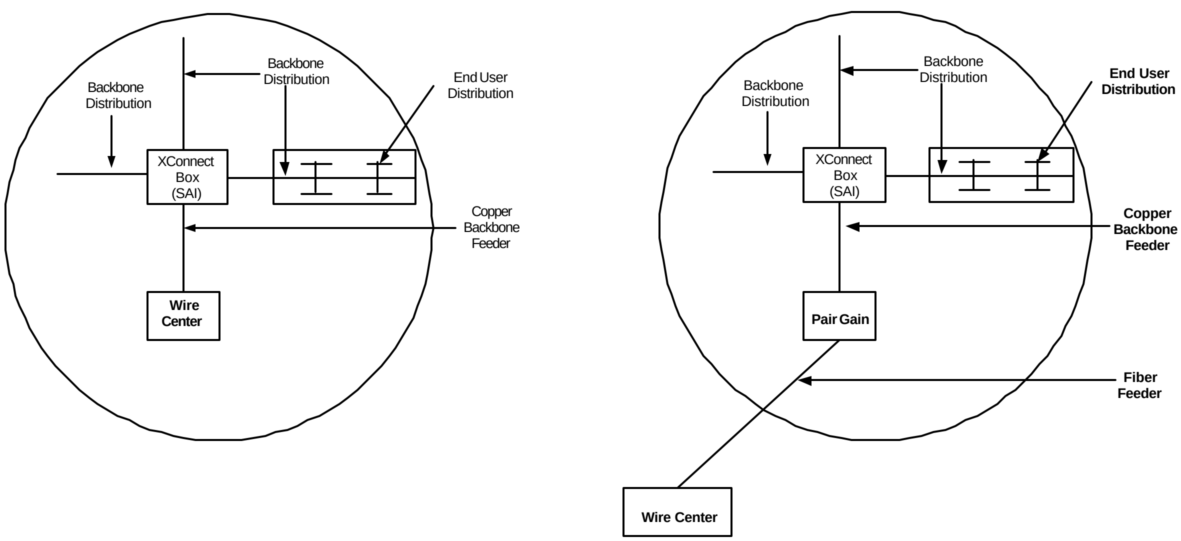


Figure 3: Core and Non-Core Local Loop Network Design

FEEDER NETWORK AND BACKBONE DISTRIBUTION DEVELOPMENT

Both feeder components, as well as the backbone distribution cable, are designed through the use of a Constrained Minimum Spanning Tree (CMST). The CMST, like all Minimum Spanning Tree algorithms, finds a set of paths between each site so that every site is connected to the main site and the total path length is minimized. If unconstrained, the algorithm would tend to generate a network in which each site has one path entering and one leaving. This tendency, when realized, produces a network that does not resemble the cable pattern typically found around a wire center. To ensure that this tendency is not realized, the constrained algorithm incorporates dummy sites called Junction Nodes. The Junction Nodes, which are pass-through sites on the x and y-axes, allow plant to be placed in each of the four cardinal directions around the wire center without violating the basic assumptions of the algorithm.

The underlying CMST algorithm used by ICM begins with a network consisting of only the wire center or ESA center, which is referred to as the Supplier Node. Additional nodes are attached to the network using a minimum distance criterion. The first step of the process involves finding the closest site or demand unit, which is referred to as a node, to the supplier node. At each subsequent step, the algorithm determines which of the nodes not yet in the network is closest to any attached node. That node is then added to the network by attaching it to the closest attached node. The algorithm proceeds in this manner until all of the nodes attached to the network. The ICM CMST algorithm results in a network in which the nodes are connected using right angle, or rectilinear, links along the axes.[6]

Fiber feeder and backbone cable segment lengths are calculated from the arc[7] distances between the nodes and are assigned an Arc Type based on their location in the network and their function as fiber feeder or backbone. While Distribution cable segment lengths are assigned an Arc Type, their segment lengths are not calculated in this manner but are set based on the Demand Style of the demand unit (see Distribution Template Design description in the Basic Engineering Assumptions section). Interoffice cable is also assigned an Arc Type. The development of the interoffice facility cable is discussed in the Interoffice Transport Module. The following table presents the Arc Type hierarchy used in ICM.

ARCType 0	The interoffice fiber cable that connects two wire centers between the closest Digital Loop Carrier (DLC) locations in each wire center serving area.
ARCType 1	The fiber feeder cables between the wire center and DLC locations in its serving area.
ARCType 2	The copper backbone cable in the core area that connects all the demand units in the core area to the wire center.
ARCType 3	The copper backbone cable in the non-core area that connects all the demand units in the non-core cluster to the DLC site serving that cluster.
ARCType 4	The copper distribution cable within the demand unit that connects all the customers to the backbone cable.

LOCAL DISTRIBUTION NETWORK DEVELOPMENT

Distribution templates are used to develop the characteristics of the local distribution plant (See Appendix C for details) and are user inputs. Templates allow the user to emulate some of the thought processes that go into designing a network, based on the characteristics of a demand unit. The distribution plant cost comprises a significant portion of a network's cost, and templates

[6] Arcs (cable segments) may be shown on the visual interface as diagonals. However, all loop length calculations and investments utilize rectilinear distances.
[7] An arc is a cable segment.

allow users flexibility in estimating the cost of a network. A more detailed explanation of the distribution templates is provided in the Basic Engineering Assumption section of this document.

PLANT MIX ALLOCATION

The plant mix comprises a combination of aerial, buried and/or underground fiber and copper cable. The percentages of aerial, buried and underground fiber and copper cable are inputs into ICM at the wire center level.

In the main feeder routes the underground cable closest to the wire center is placed first, followed by aerial and then buried cable. The total distances of aerial, buried, and underground fiber are determined first, then the percentages in the wire center are checked to see if 100% of one plant type is used. If not, and if no underground is present, then the arcs (cable segments) are assigned in order of decreasing demand, to be 100% aerial until the required aerial feeder cable is exhausted. Then the remaining feeder cable is assigned to buried.

Similarly, placement in the backbone and distribution is based on keeping underground cable closest to the wire center, followed by aerial and then buried cable. All core arcs are assigned first, in order of increasing arc level and decreasing demand within an arc level. After the core area arcs, the remaining backbone arcs are assigned, followed by distribution segments. In each case, the cables are assigned in order of increasing arc level and by decreasing demand within an arc level.

Detailed Engineering

Facility Investment Development

VERIZON MATERIAL INPUTS

Vendor contracts and GTE Advanced Materials System (GTEAMS) provide the sources of prices used in the ICM material table (see Appendix A for details). GTEAMS is the system used by Verizon to perform planning, inventory accounting, and material purchasing management functions. Engineering and costing groups access GTEAMS to obtain the current base price of materials required to estimate the cost of a project or a service offering.

Current prices for all available material codes are maintained in GTEAMS. The codes include circuit equipment, support structure, and copper and fiber cable by size. Prices are kept current through regularly updated price quotes from Verizon Purchasing and Material Management, working through Verizon Supply and its third-party vendors, and from invoices reflecting current purchases to inventory.

Third party vendor price quotes represent the current prices paid by Verizon Service Corporation for the selected material and used in the creation of purchase orders. These prices are updated quarterly on a mass basis, except that items having a significant (10 percent or more) price change may be updated more frequently. Prices for GTEAMS inventoried items are standard average unit prices based on a history of recent purchases from vendors. Material costs available from GTEAMS reflect economies of Verizon's nationwide operations and centralized supply. However, material costs input into ICM are made state specific through the addition of state specific shipping and handling costs and minor material loadings.

Material cost and the corresponding unit of measure used in ICM are listed in the following table and are described in more detail in Appendix A.

Category	Unit
Fiber Cable	$/Foot
Copper Cable	$/Foot
Drop Wire	$/Foot
Digital Loop Carrier (DLC)	$/System & $/Line
Poles, Manhole, Pull Box	$/Unit
Conduit	$/Foot
MDF & Protectors	$/Unit
Network Interface Device (NIDs)	$/Unit
Terminals	$/Unit
Cross Connect Boxes	$/Unit

VERIZON LABOR INPUTS

Similarly, vendor contracts are used to develop the state-specific labor activity rates. Verizon state-specific labor rates are used to develop costs for labor activities not included in the vendor contracts.

The vendor labor activity rates in the following table are weighted averages of all of the vendor contracts for a particular state. Each vendor contract specifies a rate per geographic area, or zone. In order to develop a composite rate for the state, the zone-specific rate is weighted by the percentage of the state's total road feet in that zone.

The weighting is determined as follows:

- The names of exchanges in each zone are obtained from the vendor contract.
- The CLLI code(s) associated with each exchange is determined from Verizon's wire center database.
- The total number of road feet within the wire center serving area is calculated as the sum of road feet for all of the demand units assigned to that wire center.
- The total number of road feet is calculated for each zone.
- The weighting for a zone is calculated by dividing the total road feet in the zone by the total road feet in the state.

See Appendix A for detailed descriptions of these materials and labor inputs. For documentation of how state-specific inputs are developed, see the *ICM Module Support Documentation* included in this filing package.

Labor activity costs are provided for items listed in the following table:

Category	Unit
Placing Copper Cable	$/Foot
Placing Fiber Cable	$/Foot
Poles, Guys, Anchor	$/Unit
Strand	$/Foot
NIDs	$/Unit
DLCs	$/Unit & $/Line
Splicing Copper Cable	$/Pair
Splicing Fiber Cable	$/Strand
Trenching, Plowing, Backhoe, Hand Digging	$/Foot
Cutting & Removing Concrete	$/Foot
Manholes & Pull Boxes	$/Unit

<u>Splicing Quantities</u>

ICM models one splice per average IPID length. An IPID (Individual Plant Identification) is the length of cable between splices in Verizon’s cable record system. IPID lengths are provided independently for copper and fiber cables. The average value of the IPID length is provided by the ICM user, and is entered in the user options table. A quantity of splices is then assigned by

ICM to each section of cable based on cable size, IPID length, and total cable footage.

DROPS AND NID INVESTMENT

Drop Wires and Entrance Cables

To determine **residential** drop investment, each demand unit is designated as having either single family or multi-family buildings based on its number of residential units.

If the number of residential units in a demand unit is less than 500, then single family dwellings with drop wires are assumed. User input determines the size of the drop wire (3 or 5 pair). The 500-line threshold is also a user input. The number of drop wires is equal to the number of residential units.

If the number of residential units is 500 or greater, then multi-family units are assumed and a 25 pair entrance cable is placed to all residences in the demand unit. The number of entrance cables is determined by assuming that each entrance cable is 50% utilized. The number of residential lines is divided by 50% of the entrance cable drop size to determine the number of entrance cables required.

To determine **business** drop investment, the number of business units in each demand unit is considered.

If the number of business units is less than 500, then drop wires are placed. The user indicates the size of the drop wire (3 or 5 pair) in the ICM input and the number of drop wires is equal to the number of business units.

If the number of business units is between 500 and 1,250, a 25 pair entrance cable is assumed for all business locations in the demand unit. For demand units with over 1250 business units, a 50 pair entrance cable is used. The 500 and 1,250 line thresholds are user specified inputs. The number of entrance cables is calculated in the same manner for residential or business units (50% utilization is assumed). The number of business lines is divided by 50% of the drop size to determine the number of entrance cables required.

Average Length of Drop Wires and Entrance Cables

The average length of the drop wire or entrance cable is calculated by determining the average lot size and assuming that the drop or entrance cable originates at the corner of the lot and terminates in the center of it.

The average lot size is calculated by taking the typical area of a demand unit and dividing it by the number of residential and business units in the demand unit. Since the drop wire or entrance cable ends in the center of the average lot, it forms a diagonal across one fourth of the lot size. The length of this cable is calculated using the Pythagorean theorem as shown below:

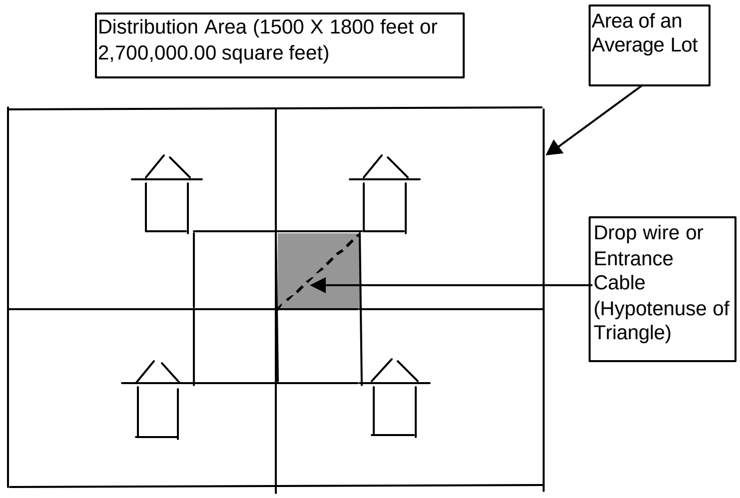


Figure 4: Calculating Drop Wire and Entrance Cable

The minimum and maximum drop lengths are user adjustable. ICM will utilize the minimum drop length in a demand unit when the calculated drop length is less than the user-input minimum length. ICM will utilize the maximum drop length in a demand unit when the calculated drop length exceeds the user-input maximum length.

Terminals and NIDs

When drop wires are used, one distribution terminal is assumed for every four residential units and for every four business units. A NID is placed for each unit.

When 12, 25 or 50 pair entrance cables are used, a 12 pair, 25 pair or 50 pair building terminal is placed. The building terminal serves as the NID. The number of building terminals is equal to the number of entrance cables in a demand unit.

Support Structure Investment Development

STRUCTURE FEET-TO-ROAD FEET RATIO

In general ICM places structure length in a wire center equal to or less than the amount of road feet in the wire center[8].

The total length of the copper backbone arcs (ArcTypes 2 and 3) in a wire center is divided by the total road feet in a wire center. In the majority of demand units, the result is subtracted from 1 to develop a percentage that is applied to the road feet in each demand unit to determine the amount of remaining road feet available for placement of distribution cable. This process prevents the sum of the length of feeder, backbone, and distribution from exceeding road feet length in the wire center.

There are two exceptions to this process. In very low-density demand units, ICM places no distribution cable, and in very high-density demand units, the reduction in road feet available for distribution cable placement is not made. Two user inputs on the distribution template determine the points at which these scenarios apply. The Distribution Demand Threshold (DDT), represents the demand unit demand below which no distribution cable is placed. The Arc 4 Demand Threshold (ARC4DT) represents the demand unit demand above which no downward adjustment is made in the distribution cable length.

AERIAL STRUCTURE

When placing aerial cable, ICM calculates a structure investment consisting of poles and anchor/down guy costs.

Pole spacing, a user controlled input, is used to determine the number of poles required for supporting a length of aerial cable. Total poles are calculated as follows: Poles = 1+ (total aerial cable length in section/pole spacing), with the number of poles rounded to the nearest whole number. Guy wire and anchor investment is determined by the user by inputting the percentage of poles requiring anchors and down guys in the user input table.

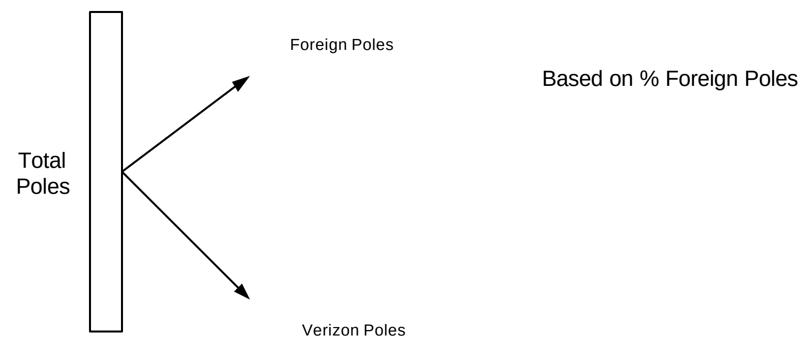
ICM assumes that 30’ poles are used for the percentage of poles that Verizon does not share, and uses 40’ poles when sharing pole space with other utilities.

POLE SHARING

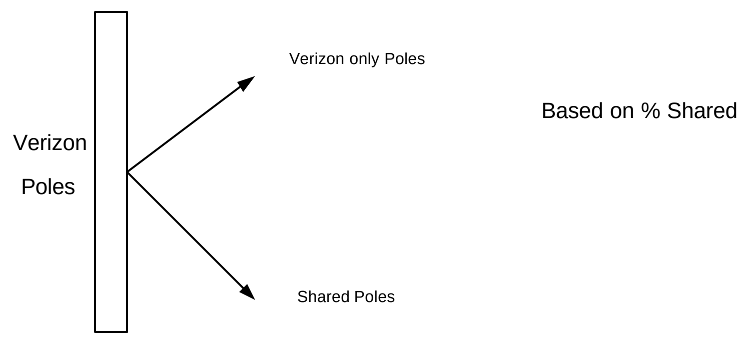
The determination of the impact of pole sharing on pole investment consists of several steps and is shown in Figure 5 below. First, the percentage of poles that are “foreign” (poles leased from power companies under contract based on input by user) are subtracted from the total number of poles. Expense for leasing space on these poles from power companies is included in the cost for

[8] Certain road types are excluded from the road feet calculation. Refer to the section “Road Length Identification Data Development Based On TIGER Files” of this document for a listing of excluded roads.

structure in the Expense Module. Second, the pole sharing percentage input by the user is applied to the remaining poles to determine the number of poles that are shared by Verizon. Third, Verizon’s portion of the shared pole investment is determined by dividing the total shared pole investment by the number of users attached, a user input. For non-shared poles, Verizon is responsible for all the investment. Fourth, the total pole investment is calculated by adding Verizon’s portion of the shared pole investment and the investment associated with the non-shared poles.



Verizon Poles = (1-% Foreign) (Total pole count)



$$\text{Investment} = \%\ \text{Sharing} * \left(\frac{\text{Shared Pole Cost}}{\#\ \text{of Pole Users}} \right) + (1 - \%\ \text{Sharing}) * \text{VZ Only Pole Cost}$$

Figure 5: Pole Sharing

BURIED STRUCTURE

For buried cable, the structure investment can include investments for plowing and/or trenching. Plowing for both distribution and feeder cable will occur if certain soil characteristics and user settings are met and certain demand levels are not exceeded. Other construction charges, including hand digging, boring, and concrete cutting and replacement do not apply when plowing is utilized.

BURIED DISTRIBUTION CABLE STRUCTURE

The Model assumes plowing in all circumstances except where more than two cables are required, where bedrock is too close to the surface to allow cost-effective plowing, or where the area is too developed to effectively plow. A user-input[9] determines whether an area is too developed for plowing.

When plowing cannot be used to place buried cable, the cable is placed with a trencher. The conditions required for plowing or trenching to occur for buried distribution cable are summarized in the table below. When a trencher is used to place distribution cable, additional labor items can be added at the user's discretion to reflect increased route congestion and urban conditions. These items[10] include boring, hand digging, concrete removal and replacement. Boring, hand digging and concrete removal and replacement activities are primarily found in urban areas. Rock sawing is needed when the bedrock is closer to the surface, and can occur in rural as well as urban areas. The Model determines the rock-sawing requirements.

Condition	Distribution - Plow	Distribution - Trench
Plow Flag	1 = Plowing Allowed	0 = No Plowing
Depth to Bedrock	> 30"	< 30"
Sharing (Users- Trench under Options/User)	< = 2 Users	>2 Users
Separation	Random	Random

BURIED FEEDER AND BACKBONE CABLE STRUCTURE

As in the distribution network, feeder and backbone cables will be plowed when three conditions are met. The first condition, analogous to the '0' and '1' setting of the PLWFLG indicator in the distribution network, involves the density of the wire center. Feeder and backbone cables may be plowed only when the wire center serving area is labeled as a low density wire center (less than 50 lines per square mile - designated as Low Density in the XXNODES.DB table).

[9] The Plow Flag (PLWFLG) in the Distribution Style Table (see Appendix A) must be set to a value of 1 for the demand unit style in which plowing is desired. The PLWFLG default settings on the Distribution Style Table allow for plowing in the three demand unit styles that contain the lest road feet. The default settings reflect the fact that plowing is most practical in areas with little road feet, i.e., rural, open areas with few underground obstructions.

[10] These items are user-input and controlled by the Structure Flag (STRFLG) on the Distribution Style Table (see Appendix A). A '0' in the STRFLG field indicates that no additional items are required. A '1' in the field will add the additional items on a percentage basis as input in the user inputs. And, a '2' in the field reflects a very dense scenario with many underground obstacles.

The second condition requires that only non-shared construction may be plowed. Since random separation is not allowed in the feeder network, the required separation between Verizon and other facilities cannot be achieved by plowing the cable.

Third, the bedrock must be below the surface far enough to allow sufficient cover, i.e., 30” for copper cable and 48” for fiber cable. However, to avoid the additional expense of trenching and rock sawing for fiber placement when bedrock is between 30” and 48”, ICM allows fiber cable to be plowed at 30” within a protective subduct.

Additionally, the cost of pre-ripping, an activity used in conjunction with cable plowing to loosen up very hard soil conditions, is added to the cost of plowing fiber cable in ICM at a 10% rate. For example, if 1000’ of fiber cable is placed, 100’ is assumed to require pre-ripping. Pre-ripping is not applicable to copper cable placement.

As with distribution cable, a trencher is used to place feeder or backbone cables when plowing is not possible. Also, as with distribution cable, the user options for the percent boring, hand digging and concrete removal and replacement are applied only under certain conditions. Unlike distribution cable, however, the wire center density is the sole determinant of the application of these factors. If the wire center is high or medium density (over 50 lines per square mile) the user input percentages of boring, hand digging, and concrete removal and replacement are applied. No boring, hand digging, or concrete removal and replacement are applied in low-density wire centers.

In non-sharing scenarios for feeder and backbone cables, rock sawing is added to the cost of trenching if bedrock is within 30” of the surface. If sharing exists, rock sawing is added to the cost for the trench if bedrock is within 42” of the surface to allow for the placement of the sharing facility. See figure 4 for a pictorial representation of the sharing scenario in feeder and backbone facilities.

An overview of the conditions required for feeder and backbone cables to be plowed or trenched is provided below:

Condition	Feeder - Plow	Feeder - Trench
Demand in Wire Center (as shown in Density column of XXNODES.DB)	< 50 lines per square mile (Low Density)	> 50 lines per square mile (Medium or High Density)
Fiber Feeder - Depth to Bedrock (Soil in XXNODES.DB)	> 48” no subduct required 30”- 48” subduct required	< 30”
Copper backbone - Depth to Bedrock (Soil in XXNODES.DB)	> 30”	< 30”
Sharing	Not permitted - 12” separation required	Sharing permitted

TRENCH SHARING

Trench sharing is shown in Figure 6 below. As with conduit and pole sharing, a user input determines the extent of trench sharing. For shared trenches, the total cost of the trench is divided by the number of parties who use the trench (including Verizon) to determine the portion of the shared investment for any party, including Verizon. For non-shared trenches, Verizon is responsible for all of the investment. The shared and non-shared trench investments are weighted using the percentage trench-sharing factor.

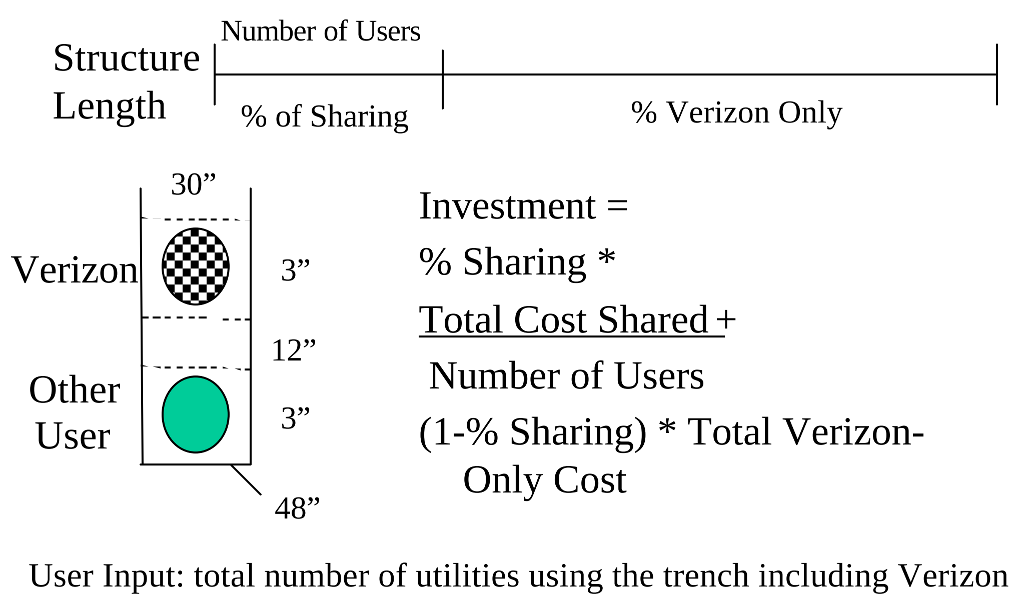


Figure 6: Trench Sharing

UNDERGROUND STRUCTURE

Underground structure consists of ducts, sub-ducts, manholes, and pullboxes. Underground cable is always placed inside ducts. ICM places a minimum of two ducts in underground facilities, with additional ducts and pullboxes and/or manholes placed when the situation warrants.

UNDERGROUND DISTRIBUTION CABLE STRUCTURE

In the distribution network, the placement of pullboxes and manholes depends on the business line demand in the demand unit. In demand units with six or less business lines, ducts are placed without pullboxes or manholes. In demand units containing between 7 and 60 business lines, pullboxes are placed as long as the number of ducts required does not exceed two. The total number of ducts is the sum of ducts used by Verizon and other users and is determined by cable demand and the number of duct users shown in the inputs. When demand units contain more than 60 business lines, manholes are placed. A user input determines manhole and pullbox spacing for distribution cable.

UNDERGROUND FEEDER AND BACKBONE CABLE STRUCTURE

For backbone cable (copper), pullboxes are used if the demand used for cable sizing is less than 400 lines and two or fewer ducts are required. As in the distribution network, the total number of ducts is the sum of ducts used by Verizon and other users and is determined by cable demand and the number of duct users shown in the inputs. Manholes are placed when either the demand exceeds 400 lines or more than two ducts are required. Also as in the distribution network, a user input determines manhole and pullbox spacing for backbone cable.

In the fiber feeder network, fiber cables are placed in 1” subducts inside 4” ducts. Up to three 1” subducts can be placed in the 4”ducts. In the vast majority of cases, pullboxes are placed in the fiber feeder network and are spaced according to the user established pullbox spacing. However, in the rare instance that more than six fiber cables are required along a route, manholes will be placed along the fiber route and spaced according to the pullbox spacing input.

DUCT PLACEMENT

ICM places a minimum of two ducts for underground facilities using a trencher to provide a 30” cover. If the cable demand and sharing require that more than two ducts be placed, a backhoe is used. The initial depth setting for a backhoe is for a 36” deep trench, which would provide the necessary 30” cover for 2 ducts. However, when 3-12 ducts are required, ICM applies the required additional 12” of trench depth, and if more than 12 ducts are placed, a second additional 12” of trench depth is added. The appropriate rock sawing investment is applied to the trenching if bedrock is within 36” of the surface.

In addition, investment for concrete removal and replacement is applied per the percentages input by the user.

Regarding the type and size of duct system, the standard duct formation sizes are 2, 4, 6, 9, 12, 15, 18 and 21. The number of 4” ducts required for copper cable placement equals the number of cables required that fit the standard formation. For example, if two copper cables are required, two ducts are placed. If three copper cables are required, four ducts are placed. The number of 4” ducts required for fiber cable equals the number of fiber cables divided by 3 (rounded up) that fit the standard formation.

MANHOLE PLACEMENT

As mentioned, extensive underground cable construction, when defined in ICM by certain demand parameters, requires placement of manholes. Manholes are generally placed using a bid procedure. ICM uses a Verizon broad-gauge price to estimate the cost of manhole placement. In addition, ICM recognizes the effect that bedrock and the water table has on manhole placement. If the water table level is within 48” of the surface, well points are added. Likewise, if bedrock is located within 72” of the surface, ICM includes additional labor to place the manhole.

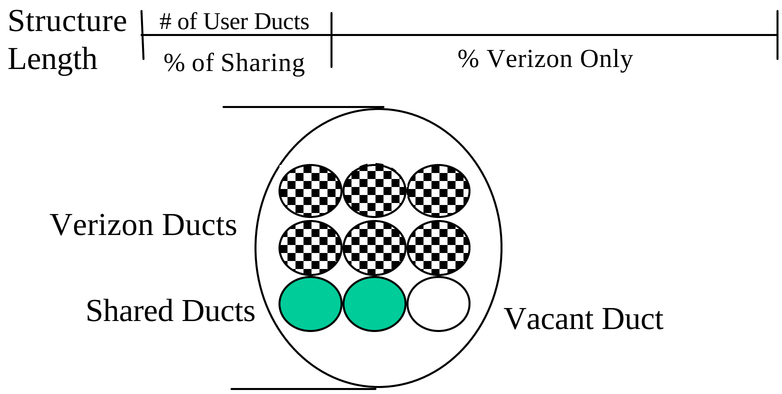
PULL BOX PLACEMENT

Pull box placement rates have been established in Verizon’s standard construction contracts and are used in ICM to reflect the cost of pullbox placement. The placement cost of a pullbox is increased when bedrock is within 36” of the surface. Unlike manhole placement, however, pullbox placement is not affected by the presence of a high water table.

CONDUIT SYSTEM SHARING

Conduit sharing is shown in Figure 7 below. The number of ducts is based on the total ducts needed by all parties (Verizon and others). In the sections of the conduit that are shared between Verizon and others, the number of ducts required by the other parties is added to the number of ducts required by Verizon. The Loop Module determines the number of ducts required by Verizon based on the number of working lines. The number of ducts required by other parties is also a user input. The total shared conduit investment is based on the total duct requirement of all parties. Verizon’s portion of the total shared investment is calculated by dividing the number of Verizon ducts, including required vacant ducts, by the total number of ducts.

In sections of the conduit that are not shared with other parties, the conduit is sized based on the requirement of Verizon only. Verizon is responsible for the entire investment of non-shared conduit. The percentage of sharing of conduit is also a user input.



Investment = % Shared * Total Cost of Shared System * (# Verizon & Vacant Ducts/Total Ducts) + (1 - % Shared) * Total Cost of Verizon Only System

User Input: Ducts Required for Other Companies' Use

Figure 7 : Conduit Sharing

Distribution Template Design

ICM utilizes a set of nine distribution templates to emulate distribution network designs based on varying ranges of road feet in a demand unit (see Table below). The templates were designed by starting with a demand unit that contained an amount of road feet that fit into the highest range. This demand unit contained a crosshatch pattern of streets (See the patterns in Appendix C). The nine distribution styles were then developed in steps (pruning cable sections from the previous styles) to ultimately place the minimum number of cable sections required to account for the minimum range of road feet.

The specific designs were used to reflect the cable patterns that would typically be placed as the road feet increases in a demand unit from very little road feet to the maximum road feet. The styles start with two single sections splitting off the backbone and expand to four cable networks containing several sections each. Each design section represents a section of distribution cable that would be required to serve the road feet in the demand unit. Each design segment is a collection of sections with the same demand.

The entire density range, from the least dense area to the most dense areas are modeled by these designs. In rural areas (little road feet in the demand unit) the design models only a few short cable sections splitting off from the backbone cable. This design reflects just a few side streets being served from the main road where the backbone would be placed. As the road feet increase, the number of cable sections increases to reflect a more complex street layout. The distribution style #9 models a very dense street pattern.

Distribution Styles	Minimum Value of Road Feet	Maximum Value of Road Feet
1	0	500
2	501	1000
3	1001	3000
4	3001	5000
5	5001	7000
6	7001	9000
7	9001	11000
8	11001	12500
9	12501	99999

In the above table, Column One lists the nine distribution styles, and Columns Two and Three list the minimum and maximum value of road feet that a given distribution style will support. The selection by a user of a particular style, out of the nine distribution styles listed in the above table, will depend on the ranges of road feet in demand unit.

The Distribution Style Table (Appendix A) contains the coefficients that mathematically represent the length and size of the sections developed through the nine distribution templates. In addition it also contains a set of inputs that allow users to perform sensitivity analyses on the distribution network. These inputs include the plow flag (PLWFLG), the structure flag (STRFLG), the structure high-density threshold (StrHDT), the average length fraction (AvgLenFrac), the distribution demand threshold (DDT), and the ARC4 demand threshold (ARC4DT).

For a description of all items included in the Distribution Style Table, reference Appendix A, Distribution Style Table. Also, see the 'Buried Structure' section earlier in this document for a discussion on the PLWFLG and STRFLG settings.

Cross Connect (SAI) Development

ICM 4.2 utilizes user-controlled demand and distance parameters to position and size Serving Area Interface (SAIs) in the network. Following is a description of the method Verizon uses to locate and size SAIs in ICM 4.2.

DEFINITIONS:

Core Clusters: Cluster that surrounds the wire center. All points in the core cluster are within a pre-determined distance from the wire center, usually 12kft.

Non-Core clusters: Any cluster containing points beyond the 12kft pre-determined distance from the wire center.

Primary SAI: In non-core clusters this SAI is placed adjacent to the DLC at the center of the cluster. Primary SAIs are not placed in core clusters.

Secondary SAI: In core and non-core clusters, this SAI(s) is placed along a route(s) away from the center of the cluster.

Critical distance: User input, which establishes the minimum distance from the center of the cluster (wire center in core clusters, DLC in non-core cluster) to a possible secondary SAI location. A secondary SAI will not be placed closer to the cluster center than this distance. This input is listed under the OSP feeder options and is labeled 'Min Distance'.

Primary demand trigger: User input demand level that triggers placement of a primary SAI in a non-core cluster. Not used for core clusters. This input is listed under the OSP feeder options and is labeled 'Min Size 1'.

Secondary demand trigger: User input demand level that triggers placement of a secondary SAI. Used in core and non-core clusters. This input is listed under the OSP feeder options and is labeled 'Min Size 2'.

Secondary size factor: User input factor, which is multiplied by route demand to calculate the secondary SAI sizes. Default is 3.0. Used in both core and non-core clusters. This input is listed under the OSP feeder options and is labeled 'Factor'.

SAI LOCATION AND SIZE DETERMINATION

The determination of SAI size and location is dependent on the type of cluster (core or non-core) and the four user inputs defined above: critical distance, primary/secondary demand triggers, and secondary size factors. In addition SAI sizing is affected by two other user inputs; the feeder factor and the administrative fill factor. All references to demand relating to SAI sizing in the following paragraphs reflect adjustments by these two factors.

In both types of clusters, demand is accumulated on a route basis to determine if a secondary SAI is required on the route and, if so, the SAI size(s). Demand is accumulated from the end of the route toward the cluster center until it equals the demand required to place the maximum size SAI (maxdemand) or until the critical distance is encountered.

If maxdemand is reached before the critical distance, the maximum size SAI is placed and the demand accumulation begins again, taking the excess demand from the original accumulation into consideration. For example, if the first demand accumulation results in 100 lines more than required to place the maximum size SAI, the 100 lines are included in the second demand accumulation. This process continues until the critical distance from the center is encountered. The demand remaining at the critical distance is then multiplied by the secondary sizing factor to determine the proper size SAI at the critical distance point. The secondary sizing factor is defaulted to 3.0, which signifies the typical SAI setup of one pair 'in' and two pairs 'out'. If the route critical distance is encountered before maxdemand is accumulated, the demand at the critical distance point is multiplied by the secondary sizing factor to determine the SAI size at the critical distance point. Finally, if the demand accumulated for the route at the critical distance point does not exceed the secondary demand trigger, a secondary SAI is not placed along that route.

CORE CLUSTER SAIS

From an SAI perspective, core clusters differ from non-core clusters in one respect. Whereas non-core clusters contain primary and secondary SAIs, core clusters contain only secondary SAIs, i.e., SAIs placed along a route, and do not contain primary SAIs. This recognizes the fact that the MDF of the switch can generally serve as a surrogate SAI. Consequently, the primary SAI algorithms and user inputs do not apply to core area clusters.

NON-CORE CLUSTER SAIS

Secondary SAIs in non-core clusters are located and sized in the same manner as core cluster SAIs. In addition, non-core clusters can also contain primary SAIs. Non–core clusters are served by Digital Loop Carriers (DLCs) with a built-in cross-connect strip that is generally large enough to cross connect approximately 200 pairs. When the capacity of the internal strip is exceeded, it becomes necessary to place a primary SAI, i.e., an SAI at the center of the cluster. The primary SAI differs functionally from the secondary, or route, SAIs in that the primary SAI does not specifically provide a feeder/distribution interface, but provides an access point for technicians to rearrange and redirect circuits without having to gain access to the DLC.

The primary SAI is placed if the cluster demand exceeds the primary demand trigger set by the user, typically 200 lines. Because the primary SAI is not used as a feeder/distribution interface, it is sized on the basis of 2 times demand, which sizes a SAI large enough to provide for one pair 'in' and one pairs 'out'.

Engineering Factors

Engineering factors are user adjustable inputs that are applied to the existing demand to correctly size cables and other items for current and anticipated demand according to Verizon practices. The Distribution Engineering Factor is applied to demand in copper distribution cable and the Feeder Engineering Factor is applied to demand in copper feeder cables and SAI's.

Average Loop Length Calculation

The average loop length is calculated based on the feeder and backbone length to the demand point plus the average distribution length. The average distribution length is calculated by applying an average length factor in the ICM code to the road feet quantity in each individual demand unit. An average length factor for a particular distribution style table represents the proportion of the average distribution length (within the demand unit) is to the total distribution length in that demand unit.

Loop Module Outputs

Below are the key investment outputs from the Loop Module. The total number of lines and the investment by network component are passed to the Mapping/Report Module, where monthly costs are developed. The number of lines per wire center is passed to the Switch Module for sizing purposes.

Loop Module outputs include investments for:

- Feeder Cable
- Distribution Cable
- Support Structures (poles, conduit, manholes, pullboxes, etc.)
- Terminals
- Drops
- NIDs
- NGDLCs
- Main Distribution Frames (MDF)
- MDF Protectors.

CONCLUSION

ICM 4.2 provides the most accurate estimates of the long run incremental costs of the local loop. The distribution areas are defined by 1/200th degree by 1/200th degree demand units that provide a 4-fold increase in resolution over ICM's previous demand units. An efficient and accurate clustering algorithm creates groups of these demand units in order to define pair gain locations or ESAs. The pair gain locations are connected to the wire center using a constrained minimum distance spanning tree (CMST) algorithm. This minimum spanning tree method is also used to model the backbone loop between the pair gain locations and the serving area interfaces. Distribution plant layout is modeled by the use of road feet and typical street layouts, or "demand style templates."

Loop cost outputs from ICM reflect forward-looking technologies, vendor prices, and provisioning rules. For example, the outside plant placement is based on having underground cable closest to the wire center, followed by aerial, and then buried cable. All of the most current cable, electronics, structure, and labor prices are used. The model also accounts for both the sharing of cable between feeder and interoffice routes and the sharing of structure between Verizon and other carriers.

APPENDIX A: Data Input Tables (Loops)

The data input tables are listed below. The tables can be viewed and printed by using the tool bar to select **View Tables / Loops** or **View Tables / Common**. The name of each database file is listed; often the first two letters indicate state (that is, in "xxexbase.db", "xx" would correspond to the state). A user may modify data in all of the tables listed below. Detailed descriptions of each of the tables are provided in the following section.

Following the description of data input tables, a bubble chart for Distribution and Feeder components of the Loop is provided under the heading 'Processing Flow'. The Distribution and Feeder bubble charts contain a graphic presentation of the database files that are inputs to and outputs of these two components.

Loops

- Demand
  - Demand Data (XXDemand.DB)
  - Distribution Style (XXTemplt.DB)

- Material
  - Outside Plant Material (XXMATL.DB)

- Placement Costs
  - Outside Plant Placement Costs (XXLABR.DB)

- Processing Flow
  - Distribution
  - Feeder

Demand Table [XXDemand.DB]

Purpose: Lists geographic and demographic characteristics (road length, bedrock, water table etc.) of each demand unit.

For More Information: See Loop Module - Commercially Available Data and Appendix B – Stopwatch Maps

Note: This table is very large and printing it is not recommended.

Column Headings:

CLLI	The 11-character CLLI code of the switch within the wire center's boundaries that is closest to the centroid of the demand unit
X	The horizontal location from the central office of a demand unit. A positive number indicates that it is that many units to the right of the central office. A negative number indicates that it is that many units to the left of the central office. A zero would indicate that it is directly above or below the central office depending on the Y value.
Y	The vertical location from the central office of a demand unit. A positive number indicates that it is that many units above the central office. A negative number indicates that it is that many units below the central office. A zero would indicate that it is directly to the left or right of the central office depending on the X value.
MAP INFO	Verizon generated character string used to identify the area that a switch serves.
ROAD LENGTH	Total length of road, in feet, within a demand unit
BEDROCK	Average minimum depth to bedrock in inches. The measure will vary from region to region.
WATER TABLE	Average minimum depth to water table in inches.
RES LINES	Number of residential telephone lines is adjusted to reflect Verizon's ARMIS line counts per wire center.
BUS LINES	Number of business telephone lines adjusted to reflect Verizon's ARMIS line counts per wire center.
WATER FLAG	True/False options (the flag is set but is not currently in use).

ELEVATION CODE	Elevation within the demand point in feet. Measures level above ground and the unit of measure is 1000 feet (Not currently used).
HIGHWAY FLAG	True/False options (the flag is set but is not currently in use).
X CLUSTER	Identifies cluster location relative to Y-axis.
Y CLUSTER	Identifies cluster location relative to X-axis.

Distribution Style Table [XXTemplt.DB]

Purpose: Specifies the nine distribution styles by number of road feet. Distribution styles are primarily identified by the number of road feet contained within the demand unit boundary. A distribution style was developed to represent each category of road feet and to serve as the starting point for the unique distribution architecture developed for each demand unit.

Column Headings:

Minval	Minimum number of road feet value for distribution style
Maxval	Maximum number of road feet value for distribution style
RCOEF1	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF2	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF3	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF4	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF5	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF6	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF7	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
RCOEF8	Coefficient used to determine amount of cable feet associated with a particular cable segment within the minimum/maximum road feet value.
DCOEF1	Determine the demand associated with a particular cable segment
DCOEF2	Determine the demand associated with a particular cable segment

DCOEF3	Determine the demand associated with a particular cable segment
DCOEF4	Determine the demand associated with a particular cable segment
DCOEF5	Determine the demand associated with a particular cable segment
DCOEF6	Determine the demand associated with a particular cable segment
DCOEF7	Determine the demand associated with a particular cable segment
DCOEF8	Determine the demand associated with a particular cable segment
PLWFLG	Plow Flag 0 = can not plow; 1 = can plow if soil conditions permit
STRFLG	Structure Flag 0 = Does not Allow Percent Hand Dig, Percent Bored, and Percent Concrete to be applied, 1 = Uses User Input Percent Hand Dig, Percent Bored, and Percent Concrete, 2 = Uses preset Percent Bore, Percent Concrete values
STRHDT	Structure High Density Threshold. Demand unit business unit level above which the preset percent bore and percent concrete placement percentages (STRFLG=2) are utilized. Will override a STRFLG setting of 1.
DDT	Distribution Demand Threshold. When demand unit demand is less than DDT no Arc 4 distribution cable is placed.
ARC4DT	Demand threshold per sq. mile for Arc type 4 only. If square mile demand is >= to the ARC4DT value the road-feed adjustment is set to 1

Outside Plant Material [XXMATL.DB]

Purpose: Lists the material unit prices for outside plant hardware. This table is used in both the Loop and Transport Modules. Each field in the OSP Material Table is defined below.

Column Headings:

MATERIAL TYPE	Abbreviation for the type of equipment (for example, CUBUR for copper buried cable and POLE30 for a 30-foot pole). If the equipment is made up of multiple components, they are listed accordingly in the OSP Material table below.
SIZE	Size of the outside plant material (for example, 600 for a 600-pair underground copper cable).
DESCRIPTION	Brief description of the equipment and its purpose.
UNIT PRICE	Investment in the equipment per unit. This cost includes all components associated with any defined material type.
MINOR MATERIAL	Indicates Major or Minor Material Item (True or False). If True, the item is classified as Minor and its cost is not used towards network investment. If False, the item is classified as Major and its cost is used towards network investment.

OSP Material Input Descriptions

Below is a table describing the outside plant material inputs used in developing the investments for loop and transport components. The user can modify the prices associated with these materials and/or insert or delete inputs. Adding a material input may require the addition of a related labor activity input.

* Labor code conventions for Digital Loop Carrier (DLC) are as follows:

1st & 2nd Characters

LC Loop Carrier

3rd Character

B Basic
C Coin
D Digital Data Service
I Integrated Services Digital Network (ISDN)
4 4 Wire

4th Character

A Getting Started
B Per Line
C Loop Extender

5th Character

R Retail Price
W Wholesale Price

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES	DESCRIPTION	UNIT
ADM	Add Drop Multiplexer Equipment	3 DS-3 12 DS-3 48 DS-3	Used with OC-3, OC-12 and OC-48 SONET rings and converts between optical signals and electrical ones. The electrical signals can be at the DS-1 or DS-3 level. ADMs allow traffic from other nodes terminating at this node to be pulled off the ring. ADMs also allow traffic originating at this node to be added to the ring for distribution to other nodes. Traffic transiting the node is converted from optical to electrical, "cleaned up" (retimed, regenerated, etc.) and converted back to optical. Includes material loading.	Per ADM
ANCHOR	Anchor	1	10" Anchor/Guy/Guy Guard: The hardware used to balance the strain on poles caused by cable and/or wire tension and to hold or counter unbalanced stress that usually occurs at corner and dead-end poles. Includes associated engineering costs and material loading with the exception of costs associated with minor materials.	Per pole
CB	Channel Bank Common Equipment	1	Multiplexes 24 voice grade and/or data circuits into a DS-1. This channel bank contains two 24 channel shelves (digroups) for a total of 48 circuits that are multiplexed onto two DS-1 circuits. Includes material loading.	Unit

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
CBCARD	Channel Bank Card	1		A device used to interface a dedicated special service loop coming in to the phone company to a channel bank. Includes material loading. The channel bank Channelizes 48 DS0 circuits onto two DS-1 circuits.	Per Card
CONCRETE	Concrete	1		Ready mixed concrete for replacing concrete removed in the trenching process.	Linear foot
COND	Conduit	1 2 4 6 9 12 15	18 21 24 27 30 33 36	4” PVC pipes that are placed underground and used to pass telephone cables through. Includes associated engineering costs and material loading.	Linear foot
CONNCOAX		1		N/A Input code no longer applicable	
CONNFIBR		1		N/A Input code no longer applicable	
CONNTWPR		1		N/A Input code no longer applicable	
CUAER24	24 Gauge Copper Pair Aerial	25 50 100 200	300 400 600 900	24 gauge copper cables strung outside on telephone poles. Includes the copper pairs encased in protective sheathing. Includes associated engineering costs and material loading.	Sheath foot
CUAER26	26 Gauge Copper Pair Aerial	25 50 100 200	300 400 600 900	26 gauge copper cables strung outside on telephone poles. Includes the copper pairs encased in protective sheathing. Includes associated engineering costs and material loading.	Sheath foot
CUBUR24	24 Gauge Copper Pair Buried	25 50 100 200 300 400	600 900	24 gauge copper cables plowed, bored, or placed in a trench and then covered. Cables are protected against water and sharp rock damage with protective sheathing. Includes associated engineering costs and material loading.	Sheath foot

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
CUBUR26	26 Gauge Copper Pair Buried	25 50 100 200 300 400	600 900	26 gauge copper cables plowed, bored, placed in a trench and then covered. Cables are protected against water and sharp rock damage with protective sheathing. Includes associated engineering costs and material loading.	Sheath foot
CUUND24	24 Gauge Copper Pair Underground	25 50 100 200 300 400	600 900 1200 1500 1800 2100	24 gauge copper cables pulled through conduit. Includes associated engineering costs and material loading.	Sheath foot
CUUND26	26 Gauge Copper Pair Underground	25 50 100 200 300 400 600 900	1200 1500 1800 2100 2400 2700 3000	26 gauge copper cables pulled through conduit. Includes associated engineering costs and material loading.	Sheath foot
DCSC	Digital Cross-Connect System	DS-1/DS-0 DS-3/DS-1		The equipment that multiplexes and demultiplexes electronic signals and acts as a means to electronically cross-connect facilities. These are sometimes referred to as Digital Access and Cross-Connect Systems (DACS). The types of digital cross connect that are included are DCS 1/0 (between DS-1 and DS-0) and DCS 3/1 (between DS-3 and DS-1). The DCS 1/0 is not utilized for multiplexing or demultiplexing but strictly for cross-connecting facilities. The channel bank (CB) is utilized for multiplexing and demultiplexing DS-1/DS-0 signals. Includes material loading.	Per DACS
DCSP	Digital Cross-Connect System Port Equipment	DS-1/DS-1 DS-3/DS-1 DS-3/DS-3		The point of access into the Digital Cross-Connect System Network (DACS). DCS Port Equipment specifically defines interfacing line capacity of the DCS. This is a variable sensitive unit. If the DACS is used for multiplexing, this equipment performs the multiplexing. Includes material loading.	Per DACS

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES	DESCRIPTION	UNIT
DS	Digital Signal Port Card	DS-1 DS-3	The ADM plug-in card investment required for interfacing DS1 and DS3 signals. The ADM plug-in cards convert the optical signal into asynchronous DS1 (using the DS1 Port Card) or DS3 (using the DS3 Port Card) signals. Includes material loading.	Per Card
DSIEJ	Digital Signal Interconnect Electronic Jumper	DS-0 DS-1 DS-3	A wire that serves to connect the outside plant network to the switch within the wire center. Includes material loading.	Per pair
DSIET	Digital Signal Interconnect Tie Cable Jumper	DS-0 DS-1 DS-3	Similar to DSIEJ. A wire used to connect cable between two distribution frames or DSX panels within the wire center. Includes material loading.	Per pair
DSIOJ		DS-3	N/A Input code no longer applicable.	
DSITB	Digital Signal Interconnect Term Block	DS-0 DS-1 DS-3	This serves as the interconnect point of the outside plant to the inside plant equipment. The inside plant and outside plant cable are tied to the Interconnection Terminal Block to create an electrical connection. Includes material loading.	Per block
DSXC	Digital Signal Cross-Connect Common Equipment	DS-1 DS-3	Digital Signal Cross-Connect Level 1 and 3. These devices allow for the cross connecting of DS-1 and DS-3 lines. Includes material loading.	Per cross-connect
DSXJ	Digital Signal Cross Connect Jumpers	DS-1 DS-3	The wire or cable that cross connects DSX panels at the DS-1 or DS-3 signal rate. Includes material loading.	Per pair
DWIRE	Drop Wire	3 Pair 5 Pair 25 Pair 50 Pair	A copper service wire that is the loop component used to transport service from the distribution terminal to the customer’s NID. Three and five pair drop wire costs include the material loading with the exception of costs associated with minor materials. 25 and 50 pair drop wire costs include those associated with engineering and material loading.	Sheath foot

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
FDPC	Fiber Distribution Panel Common Equipment	1		The Fiber Distribution Center accepts up to twelve Connector Panel Modules (6 connections/module). Includes material loading.	Per FDC
FDPM	Fiber Distribution Panel Module	1		This module connector serves as the interface between the ADM and the outside plant facilities. Here, fibers from the outside plant environment are terminated on the panel and connected through to the inside ADM equipment fiber patch cords. Includes material loading.	Per module
FIAER	Fiber Strand Aerial	6 fiber 12 " 24 "		Fiber cable enclosed in protective sheathing that is strung on telephone poles. Includes associated engineering costs and material loading.	Sheath foot
FIBUR	Fiber Strand Buried	6 fiber 12 " 24 "		Fiber cable, including protective sheathing and waterproofing, plowed, bored, or laid directly in a trench in the earth and then covered. Includes associated engineering costs and material loading.	Sheath foot
FIUND	Fiber Strand Underground	6 fiber 12 " 24 "		Fiber cable that is placed in the underground conduit system. Includes associated engineering costs and material loading.	Sheath foot
LC4AR	Digital Loop Carrier 4 wire Basic Get Started Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail 4-Wire Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LC4AW	Digital Loop Carrier 4 wire Basic Get Started Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale 4-Wire Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LC4BR	Digital Loop Carrier 4 wire Line Card Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the 4-wire Retail line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LC4BW	Digital Loop Carrier 4 wire Line Card Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the 4-wire Wholesale line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LC4CR	Digital Loop Carrier 4 wire extended Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the 4-wire Extended Retail line. As there exists no 4-wire extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LC4CW	Digital Loop Carrier 4 wire extended Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the 4-wire Extended Wholesale line. As there exists no 4-wire extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LCBAR	Digital Loop Carrier Basic Getting Started – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail Basic Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LCBAW	Digital Loop Carrier Basic Getting Started – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale Basic Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCBBR	Digital Loop Carrier Basic Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the Basic Retail line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCBBW	Digital Loop Carrier Basic Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the Basic Wholesale line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCBCR	Digital Loop Carrier Basic Extended Line - Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the Basic Extended Retail line. This DLC Line Card is utilized to serve Basic POTS customers beyond the 12 Kft serving area up to a maximum distance of 18 Kft. The DLC line card is used only when 18 Kft copper loop length is selected under Options/User.	Per Line Delta between Extended & Non-Extended Card
LCBCW	Digital Loop Carrier Basic Extended Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the Basic Extended Wholesale line. This DLC Line Card is utilized to serve Basic POTS customers beyond the 12 Kft serving area up to a maximum distance of 18 Kft. The DLC line card is used only when 18 Kft copper loop length is selected under Options/User.	Per Line Delta between Extended & Non-Extended Card

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LCCAR	Digital Loop Carrier Coin Get Started – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail Coin Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCCAW	Digital Loop Carrier Coin Get Started – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale Coin Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCCBR	Digital Loop Carrier Coin Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the Coin Retail line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCCBW	Digital Loop Carrier Coin Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the Coin Wholesale line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCCCR	Digital Loop Carrier Coin Extended Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the Coin Extended Retail line. As there exists no Coin extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LCCCW	Digital Loop Carrier Coin Extended Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the Coin Extended Wholesale line. As there exists no Coin extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LCDAR	Digital Loop Carrier Digital Data Services Get Started – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail DDS Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCDAW	Digital Loop Carrier Digital Data Services Get Started – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale DDS Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCDBR	Digital Loop Carrier Digital Data Services Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the DDS Retail line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCDBW	Digital Loop Carrier Digital Data Services Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the DDS Wholesale line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LCDCR	Digital Loop Carrier Digital Data Services Extended Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the DDS Extended Retail line. As there exists no DDS extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LCDCW	Digital Loop Carrier Digital Data Services Extended Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the DDS Extended Wholesale line. As there exists no DDS extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LCIAR	Digital Loop Carrier Integrated Services Digital Network (ISDN) Get Started – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail ISDN Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCIAW	Digital Loop Carrier ISDN. Get Started – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale ISDN Getting Started equipment investment for the Digital Loop Carrier. This equipment is a per DLC investment. The DLC size is based on the demand within the cluster being served. Includes material loading.	Per DLC
LCIBR	Digital Loop Carrier (ISDN) Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the ISDN Retail line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
LCIBW	Digital Loop Carrier Integrated Service Network Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in equipment investment for the ISDN Wholesale line. This investment will be applied to each loop being served from this DLC. Includes material loading and maintenance spares.	Per Line
LCICR	Digital Loop Carrier ISDN Extended Line – Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the ISDN Extended Retail line. As there exists no ISDN extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
LCICW	Digital Loop Carrier ISDN Extended Line – Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in investment for the ISDN Extended Wholesale line. As there exists no ISDN extended line card, this material type is a placeholder only.	Per Line Delta between Extended & Non-Extended Card
MDF	Main Distribution Frame	1		A metal framework used for mounting the protectors (termination of the outside cable) on one side and the termination blocks for jumper cables from the switch and other central office components on the other side. Jumper wires are placed from one side to the other to complete connections.	Per Pair
MDFPROT	Main Distribution Frame Protector	1		The protection device located in the wire center, on the Main Distribution Frame, that serves as a lightning suppresser to protect the central office equipment.	Per Line
MMPOLE	Material loading for Poles	1		N/A Input code no longer applicable.	
MNHOLE	Manhole	1		A prefabricated 5’10”x10’6”x6’6” concrete manhole. Includes associated engineering costs and material loading.	Per manhole

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES	DESCRIPTION	UNIT
MUX	Multiplexer	31	The electronic equipment used in smaller switch nodes as an economical means to multiplex and demultiplex between DS-3 and DS-1. Includes material loading.	Per multiplexer
NACDSXJ		0 1 3	N/A Input code no longer applicable.	
NID	Network Interface Device Housing	1	6 pair NID housing: A network interface device housing with 6 pair capacity used to terminate the telephone company's facilities (drop wire) at the customer's location. This is also the interface device between the customer's inside wiring and the telephone network.	Per NID
NIDPROT	Network Interface Device Protector Module	1	NID protector modules for use in 6 pair NID housings. Each protector unit provides protection for one pair from hazardous voltages and currents and separates the customer's equipment from the rest of the local network. Includes material loading with the exception of costs associated with minor materials.	Per protector module
NID	Network Interface Device	12 25 50	A network interface device housing with 12, 25 or 50 pair capacity wired between a local carrier's network, where the drop wire terminates, and the inside wiring of a customer location. The 12 and 25 pair, and 50 pair module, housing, cover and clip include the material loading with the exception of costs associated with minor materials. 50 pair panel costs include the material loading.	Per NID
NIDPROT	Network Interface Device Protector Module	12 25 50	NID protector modules for use in 12, 25, and 50 pair NID housings. Each protector unit provides protection for one pair from hazardous voltages and currents and separates the customer's equipment from the rest of the local network. Includes material loading with the exception of costs associated with minor materials.	Per protector module
OC		3 12	The plug-in cards associated with ADMs used to inter-network two ADM optically without having to convert the optical signal to its electrical equivalent. The OC3 card inter-networks the terminals at an OC-3 rate, and the OC12 card inter-networks the terminals at an OC-12 rate. Includes material loading	Per Card
POLE	Telephone Pole	1	The material cost (not including labor) of a 30' Class 5 treated wood utility pole. Includes associated engineering costs and material loading.	Per pole
POLESH	Telephone Pole	1	The material cost (not including labor) of a 40' Class 4 treated wood utility pole. Includes associated engineering costs and material loading.	Per pole

MATERIAL TYPE CODE	MATERIAL TYPE	SIZES		DESCRIPTION	UNIT
PULLBOX	Pull box	1		4’x4’x4’ Handhole: A pre-fabricated 4’x4'x4’ small concrete handhole. Includes associated engineering costs and material loading.	Per pull box
STRAND	10m Strand	1		The steel suspension strand, also referred to as a “messenger”, that provides structural support to aerial cable between the poles. The aerial cable is usually attached to the strand by wire wrapped around the cable and strand. The strand also provides electrical continuity throughout the aerial exchange cable network to protect against direct contacts and lightning hazards when properly attached to the multi-ground neutral. Includes associated engineering costs and material loading with the exception of costs associated with minor materials.	Linear foot
SUBDUC	Subduct	1		A 1” or 1 ¼ “ PVC pipe through which fiber cables can be passed. Two or three subducts are usually placed in a 4” conduit to allow 2 or 3 fiber cables to be placed in one 4” duct. The subduct can also be buried directly in a trench to facilitate fiber cable placement. Includes associated engineering costs and material loading with the exception of costs associated with minor materials.	Linear foot
TERM	Pedestal Terminal	1		The loop component that serves as the access point between the distribution cable and the drop wire. The distribution terminal, in this case, is located in a pedestal and is spliced to pairs in the distribution cable to make them available for use to serve the customer. Includes associated engineering costs and material loading with the exception of costs associated with minor materials.	Per terminal
XCONN	Cross-Connect Cabinet	400 600 900 1800	2700 3600 5400	A cabinet containing termination blocks on which the feeder and distribution cable pairs are both terminated. Each type of cable is usually terminated in a designated area. Jumper wires are used to connect the assigned feeder pair to the appropriate distribution pair. The cross connect box provides flexibility (any feeder pair can be connected to any distribution pair) and allows the feeder and distribution cables to be sized differently. Distribution cables are sized for the ultimate demand while feeder cables are usually sized for 3 to 5 years growth. Includes associated engineering costs and material loading.	Unit

Outside Plant Placement Costs [XXLABR.DB]

Purpose: Provides labor costs for installing specific types of equipment and facilities. The labor requirements and tasks included in each cost are defined in the OSP Placement table below. In states where there are significant cost differences between areas, two sets of weighted average rates are developed (Tier A and Tier B).

Column Headings:

LABOR TYPE	Type of labor required, as identified by an alphanumeric code (for example, LP01A for placing a pole). The tasks involved in each type of labor are defined in the OSP Placement table below.
DESCRIPTION	A description of the work done (for example, "place anchor & guy"). These descriptions are extracted from the contracts used by Verizon and the contractor. They specifically identify the tasks that are included in any labor requirement.
TIER A RATE	Labor activity rate for Tier A areas. Used by ICM when FALSE appears in the Tier B column in the XXNODES.DB table.
TIER B RATE	Labor activity rate for Tier B areas. Used by ICM when TRUE appears in the Tier B column of the XXNODES.DB table.

Outside Plant Placement Input Descriptions

Below is a table describing the outside plant placement inputs used in developing the investments for loop and transport components. The user can modify the prices associated with these activities and/or insert or delete inputs.

* Labor code conventions for Digital Loop Carrier (DLC) are as follows:

1st & 2nd Characters

LC	Loop Carrier

3rd Character

B	Basic
C	Coin
D	Digital Data Service
I	Integrated Services Digital Network (ISDN)
4	4 Wire

4th Character

A	Getting Started
B	Per Line
C	Loop Extender

5th Character

R	Retail Price
W	Wholesale Price

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LADM	Install ADM equipment	3 12 48		Includes Engineering and Installation Labor for the placement of the OC-3, OC-12, and OC-48 ADM Common Equipment.	Per ADM
LC4AR	Install 4 wire DLC Get Started Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail 4-Wire Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LC4AW	Install 4 wire DLC Get Started Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale 4-Wire Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LC4BR	Install 4 Wire DLC Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the 4-wire Retail line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LC4BW	Install 4 Wire DLC Wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the 4-wire Wholesale line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LCB	Install Channel Bank			Includes Engineering and Installation Labor for the placement of the Channel Bank Common Equipment.	Per CB
LCBAR*	Install DLC Get Started-Retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail Basic Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCBAW	Install DLC Get Started-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale Basic Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCBBR	Install DLC Line-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the Basic Retail line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LCBBW	Install DLC Line-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the Basic Wholesale line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LCBCARD	Install Channel Bank Card			Includes Engineering and Installation Labor for the placement of the Channel Unit	Per unit
LCCAR	Install DLC Get Started-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail Coin Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCCAW	Install DLC Get Started-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale Coin Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCCBR	Install DLC Line-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the Coin Retail line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LCCBW	Install DLC Line-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the Coin Wholesale line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LCDAR	Install DLC Get Started-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail DDS Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCDAW	Install DLC Get Started-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale DDS Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCDBR	Install DLC Line-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the DDS Retail line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LCDBW	Install DLC Line-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the DDS Wholesale line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LCIAR	Install DLC Get Started-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Retail ISDN Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCIAW	Install DLC Get Started-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	The Wholesale ISDN Getting Started labor investment for the Digital Loop Carrier. This labor is a per DLC investment. Includes the Engineering and Installation labor for the placement of the DLC Getting Started equipment.	Per DLC
LCIBR	Install DLC Line-retail	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the ISDN Retail line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line

LABOR TYPE CODE	LABOR TYPE	SIZES		DESCRIPTION	UNIT
LCIBW	Install DLC Line-wholesale	24 48 96 192 224 448	672 896 1120 1344 1568 2016	Plug-in labor investment for the ISDN Wholesale line. This investment will be applied to each loop being served from this DLC. Includes the Engineering and Installation labor for the placement of the DLC Plug-In card.	Per Line
LDCS1	Install DCS1 equipment			Includes Engineering and Installation Labor for the placement of the DCS1/0 Common Equipment.	Per DACS
LDCS11P	DCS1/1 Port Eng/Install			Includes Engineering and Installation Labor for the placement of the DCS1/0 DS1 ports.	Per port
LDCS3	Install DCS3 equipment			Includes Engineering and Installation Labor for the placement of the DCS3/1 Common Equipment.	Per DACS
LDCS31P	DCS3/1 Port Eng/Install			Includes Engineering and Installation Labor for the placement of the DCS3/1 DS1 ports.	Per port
LDCS33P	DCS3/3 Port Eng/Install			Includes Engineering and Installation Labor for the placement of the DCS3/1 DS3 ports.	Per port
LDS1	Install DS1 card			The ADM plug-in card Engineering and Installation labor investment required for the placement of the DS-1 Port Card.	Per Card
LDS3	Install DS3 card			The ADM plug-in card Engineering and Installation labor investment required for the placement of the DS-3 Port Card.	Per Card
LDSX1	Install DSX1 equipment			Includes Engineering and Installation Labor for the placement of DSX-1 Cross Connect panel.	Per panel
LDSX1J	DSX-1 Jumper Eng/Install			Includes Installation Labor for the placement of DSX-1 Cross Connect jumper.	Per jumper
LDSX3	Install DSX3 equipment			Includes Installation Labor for the placement of DSX-3 Cross Connect panel.	Per panel
LDSX3J	DSX-3 Jumper Eng/Install			Includes Installation Labor for the placement of DSX-3 Cross Connect module and jumper.	Per Jumper

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LFDM	Install fiber distribution module		Includes Engineering and Installation Labor for the placement of a Fiber Distribution Panel Module.	Per Module
LFDP	Install Fiber Distribution Panel		Includes Engineering and Installation Labor for the placement of a Fiber Distribution Panel common equipment.	Per panel
LMDFPROT	Install MDF Protector		The Installation labor investment required for the placement of Protection on the Main Distribution Frame in the central office.	Per Line
LMUX3	Install multiplexer		Includes Engineering and Installation Labor for the placement of DS3/DS1 Multiplexer.	Per Mux
LOC3CARD	Install OC3 card		The ADM plug-in card Engineering and Installation labor investment required for the placement of the OC-3 inter-networking card.	Per Card
LOC12CARD	Install OC12 card		The ADM plug-in card Engineering and Installation labor investment required for the placement of the OC-12 inter-networking card.	Per Card
LP01A	Placing Pole		Includes transporting and setting pole at the proper location, depth, and alignment, compacting distributed soil (tamping), and tagging (pole number). Also includes stepping pole and disposing of surplus dirt or rock where required, and placing a butt ground when required.	Per pole
LP03A	Replaces LP0lA for shared pole		This unit applies if a pole is placed, removed, straightened, or reset in a power line when either a safety blanket or the presence of the power company is required. This unit includes all of the operations described in placing, removing, and straightening poles.	Per pole
LP07A	Place anchor & guy		Includes installing the anchor and rod(s) to the proper depth, placing and tensioning down guy and sidewalk guy, and installing guy guards. Removal of rock is included where necessary.	Per anchor
LP18A	Place strand		This covers the placement of strand, hardware, down guys, tensioning of strand, and placing ground rods/ wires as required.	Linear Foot

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LP22A	Place aerial cable		This covers all handling associated with placing aerial cable/sub-duct/cable in sub-duct on existing strand or overlashing with existing cable. Includes double lashing or delash/relash (where required), placing wire clamps, spacers, straps, cable dampers, tree/squirrel guards, riser/U-guards as required, placement of fiber tags, and any incidental tree trimming. Also includes retensioning of the existing strand and placing additional down guys, if required, to meet specifications.	Per foot
LP28A	Place cross-connect		This covers placement of all cross-connects, either pad or pole mounted. It includes forming the stub of a pre-stubbed cabinet, placing U-guard, supports, and spacers as required, up the pole or through conduit to a remote switch unit in close proximity. Also includes proper bonding and grounding, and tagging (numbering) the cabinet.	Per cross-connect
LP28D	Place xconnect pad		This covers the installation of a preformed pad (furnished by Verizon). Includes preparing the base, placing grounding materials and may include placement of up to 20 feet of conduit with up to 6 bends as required.	Per pad
LP43A	Place copper cable in conduit		This includes transportation and placement of metallic cable in conduit (including direct-buried conduit without both ends exposed) and into or through manholes, vaults, or riser locations when pull line is in place. It includes manhole set-up, placing the pull line if required, proper racking of the cable in manhole or vault, and placing cable up risers with clamps/guards, etc. Includes proofing the duct and the mandatory pressure checks to ensure that the cable has not been damaged during placing.	Per cable foot
LP43C	Place fiber cable in conduit		This covers placement of fiber optic cable in duct, and includes all handling of the cable to avoid cutting of the cable except as specified by Verizon engineering, proper racking, and placing split sub-duct over the cable in manholes or vaults. Manhole set-up, placing pull line, and proofing the duct are also included.	Per cable foot
LP49A	Place cable/duct direct		Includes all transportation, handling, and installation of one or more cables and/or a single duct in an open trench provided by Verizon. Placing riser, U-guards, cable marker stakes/posts, and ID tape/locating conductors.	Per trench foot

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LP49B	Place add cable/duct		Includes transportation, handling, and installation of an additional cable/duct or sub-duct in an open trench provided by the Contractor, including placement of risers and/or U-guards.	Per trench foot
LP50A	Place buried drop		Covers all work, including trenching, required to place one or more direct buried service wires, or service wires in duct, or the duct itself. The unit includes placement of the service wire or duct at the appropriate depth (a minimum of 12 inches), proper routing of the service wire to the serving terminal, leaving adequate slack on a pole, stake or cane as required for termination, backfill of all excavations. It does NOT include placing a protector/network interface device (NID/SNID, etc.). Manual tunneling is considered incidental and will not be reimbursed by Verizon.	Per trench foot
LP51A	Plow cable-jobs < 1000 units		This applies to plowing all types and sizes of buried cable and/or sub-duct at a depth of 30". Also includes incidental hand digging/backhoeing to expose existing substructures, or to extend trench to a pedestal or pole or any other necessary digging required for placement of cable, backfilling, compaction and restoring the property to it's original condition, placing all risers/U-guards, cable marker stakes/signs, and ID tape/locating conductors.	Per linear foot
LP51B	Plow cable-jobs > 1000 units		See "Plow cable-jobs" < 1000 (LP51A) above. Charged per linear foot.	Per linear foot
LP51C	Plow Additional 6"		This should be used in conjunction with Plow cable-jobs when additional depth is required.	Per plowed foot
LP52A	Pre-ripping		This includes preripping with a cable plow when required by adverse soil conditions to allow plowing in of buried cable and/or sub-duct.	Per linear foot
LP54A	Trench @ 30"- JOB <1000		This includes all labor and equipment required to open a trench with a trenching machine and placement of a buried cable or single conduit at a depth of 30". Also included is incidental hand digging/ backhoeing to expose existing substructures, or to extend trench to a pedestal or pole (or any other necessary digging required for placement of cable), backfilling, compaction and restoring the property to its original condition, placing all riser/U-guards, cable marker stakes/signs, and ID tape/locating conductors.	Per linear foot
LP54B	Trench @ 30"- Job >1000		See Trench @ 30"- JOB <1000 (LP54A) above. Charged per linear foot.	Per linear foot

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LP54C	Increase trench depth by 6"		This is to be used in conjunction with Trench @ 30"- Job when additional depth is required.	Per trench foot
LP55A	Backhoe @36" & place cable/con		Includes all transportation, handling, and installation of one or more cables and/or a single conduit in an open trench, 36” in depth, with the use of a backhoe. Placing riser, U-guards, cable marker stakes/posts, and ID tape/locating conductors.	Per trench foot
LP55B	Increase backhoe depth by 12"		Provides for an increased depth of 12”, to be used in conjunction with Backhoe @36”.	Per trench foot
LP57A	Hand dig trench		Includes manual removal of soil when common machinery is not the most efficient or effective method of digging a trench.	Per trench foot
LP59A	Initial bore		This applies to a successful bore or pipe push. Incidental is any associated digging, pulling through cable(s)/sub-duct, locating the end of the pipe and marking the ends (if required), backfilling, compacting, and restoring the property to its original condition. It does NOT include the cost of the pipe placed that will be provided by Verizon or billed separately.	Per linear foot
LP61A	Place pedestal		This includes the placement of an above ground pedestal. It includes placing a stake/pole mounted CAD pedestal, bringing new cable(s) into the unit, placing gravel, ground wire, attaching the ground wire to an existing MGN or placing ground rod as required, bonding and grounding, labeling and terminal decals.	Per pedestal
LP70A	Cut solid rock - per hole		This covers the cutting of solid rock during a placing operation. It includes backfilling the trench with packed soil and disposing of excess rock.	Per hole
LP70B	Rock saw		This covers the cutting of solid rock during a placing operation. It includes backfilling the trench with packed soil and disposing of excess rock.	Per linear foot
LP70C	Plow additional cable		This applies during the plowing of two cables or if a split duct is to provide additional protection to the cable (e.g., fiber optic cable placed in rocky soil).	Per linear foot

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LP73A	Splice Pit		This covers digging of a splice pit, by hand or machine. A standard splice pit is approximately 4'x5'x1' below the cable. This includes getting all utility locates, digging the pit, providing a safety perimeter around the pit if required, backfilling, compacting for proper support under the splice closure, and restoral of the surface.	Per pit
LP73B	Well Point		This will apply when well pointing is authorized due to high water table conditions. This will apply when digging a splice pit, or when providing well point(s) at 50 foot intervals for trench line. It includes any additional necessary digging as well as the installation and monitoring of the de-watering system.	Per location per day
LP87A	Rod and mandrel duct		This is used for the combination activity of rodding, mandrelling, placement of pull line and verifying end to end measurements in preparation for placement of underground cable in an existing conduit. Includes manhole set-up.	Per duct/foot
LP88A	Place sub-duct or air tube in conduit		This covers the hauling of sub-duct/air tube and associated material necessary to install sub-duct or air tube in a conduit, placing the sections together, and properly forming and securing the sub-duct/air tube to manhole walls and/or racks in manhole or cable vaults. Includes manhole set-up, and placing pull line if required.	Per duct foot
LP93C	Cut and remove concrete		This includes all labor and equipment required to cut and remove concrete by any method and haul it from the job site. It also includes backfilling the excavation with dirt, compaction of the dirt and smoothing of the surface.	Per square foot of surface
LP93D	Place concrete		This includes all labor, equipment and delivery of materials required to place concrete to required thickness. Also included is preparation and compaction of the appropriate base material (sand, gravel, limestone rock, etc) prior to placing concrete as required, according to local city, county, or state laws. This doesn't include the cost of material.	Per square foot of surface
LS02A	Straight splice 1-50 pairs		Includes the permanent connecting of individual wires of a pair to those of another pair at the junction of two or more cables. Includes set-up and closure of cable. Also includes forming/racking of cables, manhole setup, tagging and pair identification.	Per pair
LS02B	Straight splice 51-300 pairs		See Straight splice 1-50 pairs (LS02A) above. Charge is per pair.	Per pair

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LS02C	Straight splice +300 pairs		See Straight splice 1-50 pairs (LS02A) above. Charge is per pair.	Per pair
LS13A	Place fixed counted terminal		This covers the placement of any fixed count terminal (pedestal mounted, aerial, building, NID, etc.). Included is all set-up, associated splicing (straight/branch, etc.), placing seals and static stoppers, bonding and grounding as required, placing closure/ ped-caps, pea gravel/pest control (if not already completed), and labeling as required.	Per closure/ housing
LS14B	Place NID		This covers the placement of demarcation hardware (up to and including 6 pair) at a building or junction of aerial and buried plant, placement of static stoppers, and proper bonding and grounding according to Verizon practices. If placing the interface device requires a trailer/mobile home stake, placement of the stake will be included in this unit (except in areas where stakes are provided by the customer.) This unit also includes placing, moving, or removing analog or digital station channel units or repeaters.	Per NID
LS19A	Setup pedestal		This includes opening/closing the sheath in a cable which is looped through a pedestal. It includes sheath removal, bonding and grounding of cable to the pedestal, placing binder group identification markers, ped caps, pea gravel/pest control (if not already completed), and numbering the pedestal as required.	Per pedestal
LS20A	Run jumpers at any cross connect		This covers placing, removing, or rearranging jumpers at any cross-connect location, including the central office.	Per jumper
LS26A	Conduit acceptance testing		This includes acceptance testing per Verizon Practice and providing the necessary documentation of the results. It also includes Contractor provided equipment, set-up and testing.	Per pair
LS50A	Splice Fiber (48 fibers or less)		This covers the permanent connection of pigtails to a fiber of a cable or splicing a fiber of one cable to a fiber of another cable (mechanical or fusion) and associated testing. It includes sheath preparation and labeling, as required. Testing includes testing for the loss of individual splices to ensure they meet minimum requirements. It also involves end-to-end testing in both directions and documentation of the results. Includes set-up and closure.	Per fiber

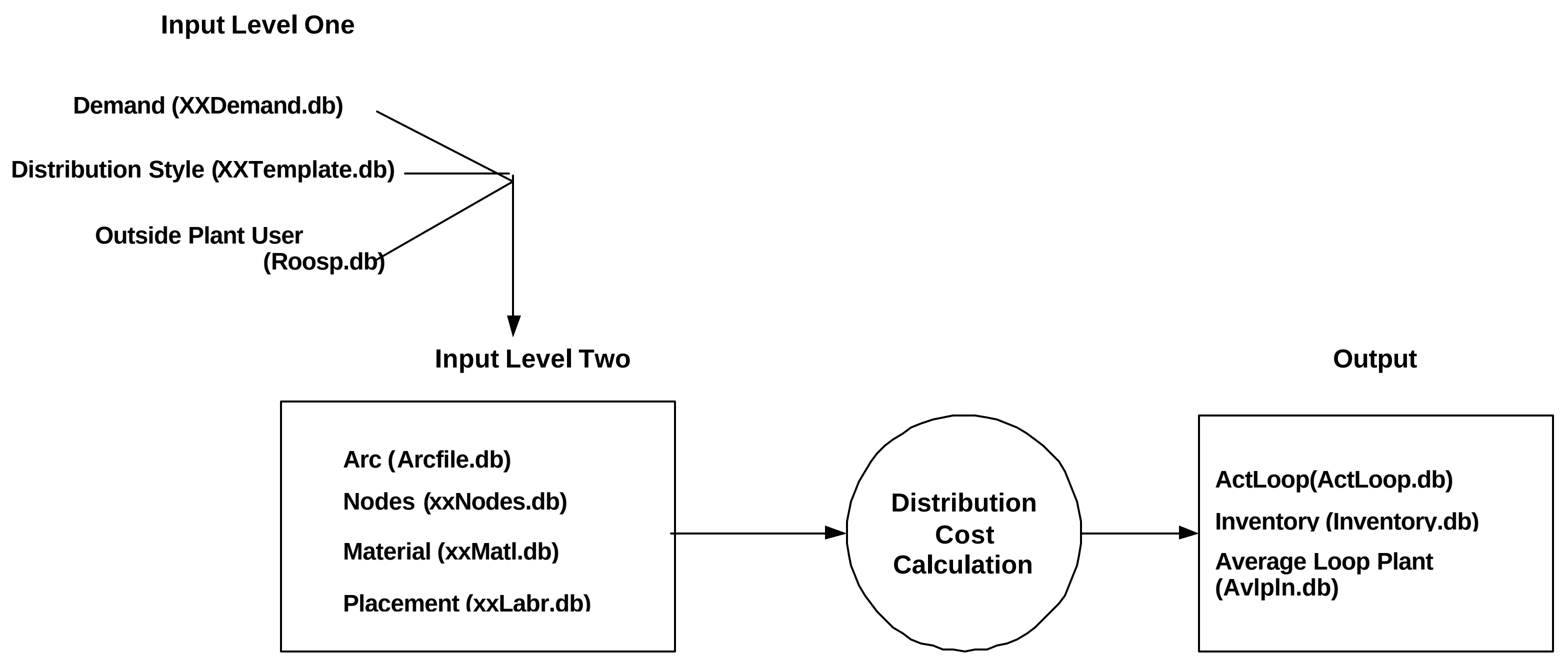
LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
LS50B	Splice Fiber (more than 48)		This covers the permanent connection of pigtails to a fiber of a cable or splicing a fiber of one cable to a fiber of another cable (mechanical or fusion) and associated testing. It includes sheath preparation and labeling, as required. Testing includes testing the loss of individual splices to ensure they meet minimum requirements. It also involves end-to-end testing in both directions and documentation of the results. Includes set-up and closure.	Per fiber
LS72A	Manhole setup for use		Included is all associated labor, material, and equipment required for preparing a manhole for entry, including but not limited to generator, water pump, blower, gas detector, manhole guard, truck and tools, and standard traffic control devices (signs and cones).	Per manhole
MNHOLE	Manhole install		This unit involves all work necessary for the installation and placement of a manhole. This unit includes the restoration of the surface in the immediate vicinity of the manhole with the appropriate material. If major restoration is required by local governing bodies, such as the entire side of a paved road, then this would be paid under other units. Manhole setup is included if required by Verizon.	Per manhole
PT001	Install Cable to Interconnect Cage		This unit covers installation or removal of new or existing cable to any interconnect cage.	Per foot
PT002	Install DS0 Jumper @ Frame		This unit covers the installation or removal of a DS0 jumper to any designated frame.	Per jumper
PT003	Install DS1 Jumper @ DSX		This unit covers the installation or removal of a DS1 jumper to any Digital Signal Cross Connect Box.	Per jumper
PT004	Install DS3 @ DSX		This unit covers the installation or removal of a DS3 jumper to any Digital Signal Cross Connect Box.	Per jumper
PT005	Install Conn Block @ Frame		This unit covers the installation of the connector block at the main distribution frame.	Per block

LABOR TYPE CODE	LABOR TYPE	SIZES	DESCRIPTION	UNIT
PULLBOX	Pull box installation		This unit involves all work necessary for the installation and placement of a pull box. This unit includes the restoration of the surface in the immediate vicinity of the manhole with the appropriate material. If major restoration is required by local governing bodies, such as the entire side of a paved road, then this would be paid under other units. Pull box setup is included if required by Verizon. Note: Restoration of the surface will be limited to an area within five feet of the perimeter of the pull box lid.	Per box

Processing Flow

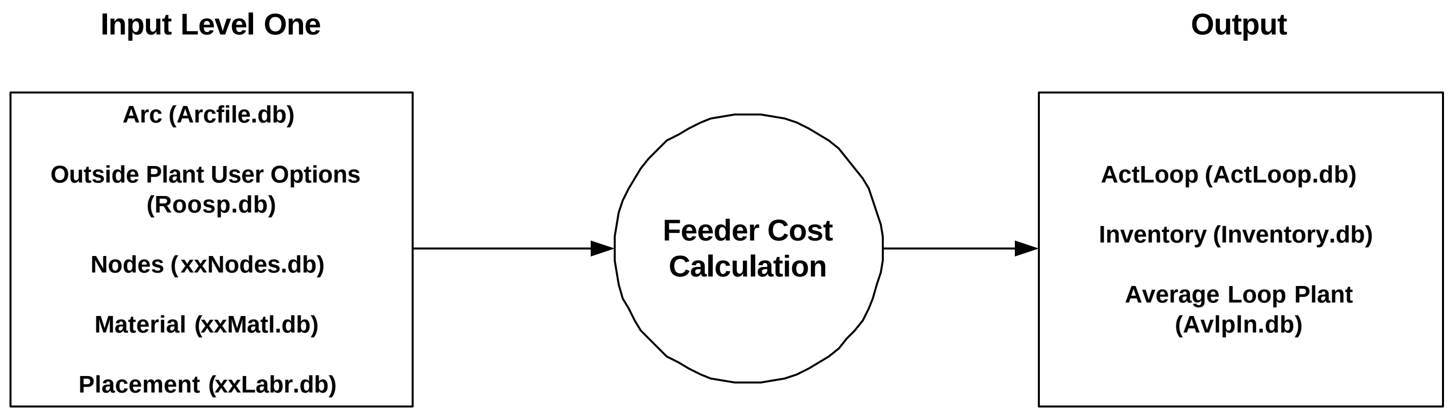
The Distribution bubble chart provides a graphic view of the database files that are input to and output of the Distribution portion of the Loop Module.

Distribution Bubble Chart



The Feeder bubble chart provides a graphic view of the database files that are input to and output of the Feeder portion of the Loop Module.

Feeder Bubble Chart

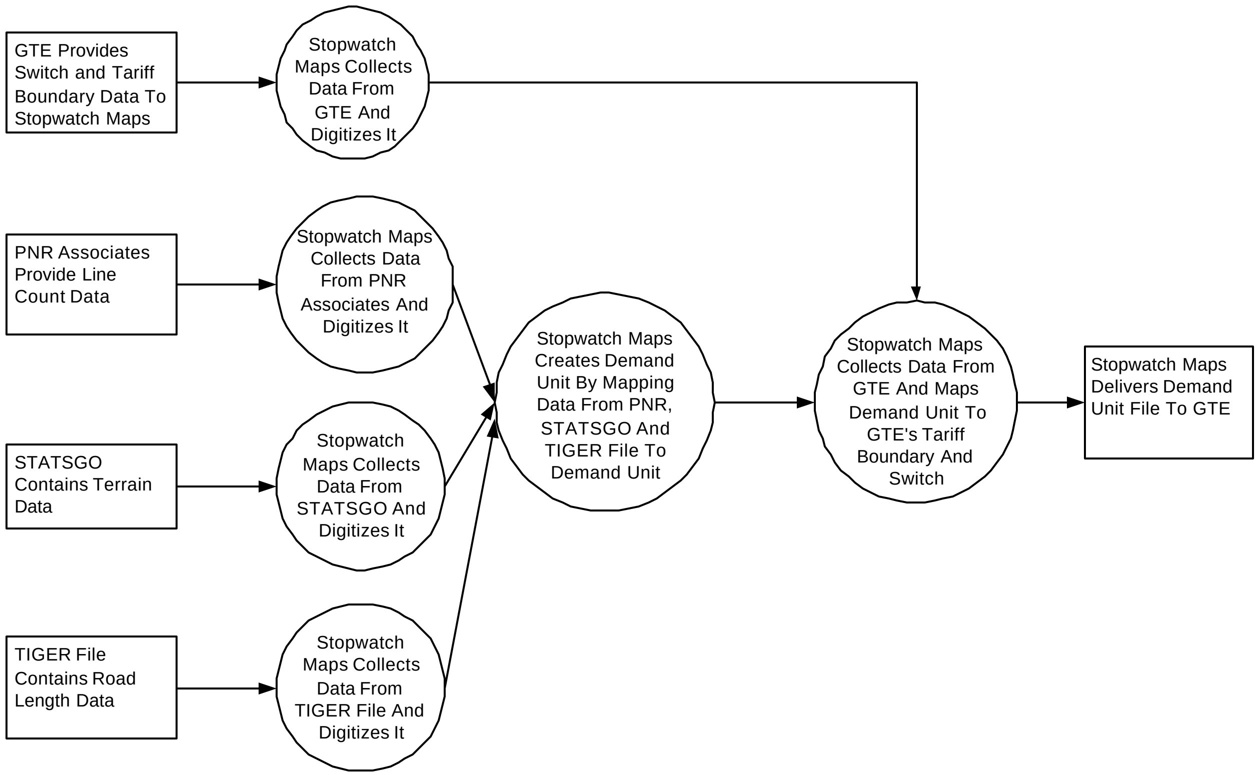


Appendix B: Stopwatch Maps' Role In Generating Data Unit File

The basic building block of the ICM loop module is the 1/200th by 1/200th degree *demand unit*, each of which contains line counts (residential and business), road feet, and terrain conditions such as bedrock depth, and water table depth. All of the data mapped to the demand units is based on publicly available information. The lines counts, available at the census block level, are purchased from PNR Associates and are based on US Census data. The road information comes from the TIGER Files, and the terrain data comes from STATSGO. Roads and terrain data are purchased from Stopwatch Maps.

In addition to providing terrain and road data, Stopwatch Maps also distributes the various categories of information to demand units and assigns demand units to wire centers using a sophisticated Geographic Information System (GIS) software package. The software used by Stopwatch Maps allows the data, that has been collected by census block and is highly irregular in size and shape, to be accurately mapped to the standard 1/200th degree demand units. The flow charts below illustrate the flow from the raw inputs, through pre-processing, to standardized demand unit data outputs.

Demand Unit File Process Used By Stopwatch Maps

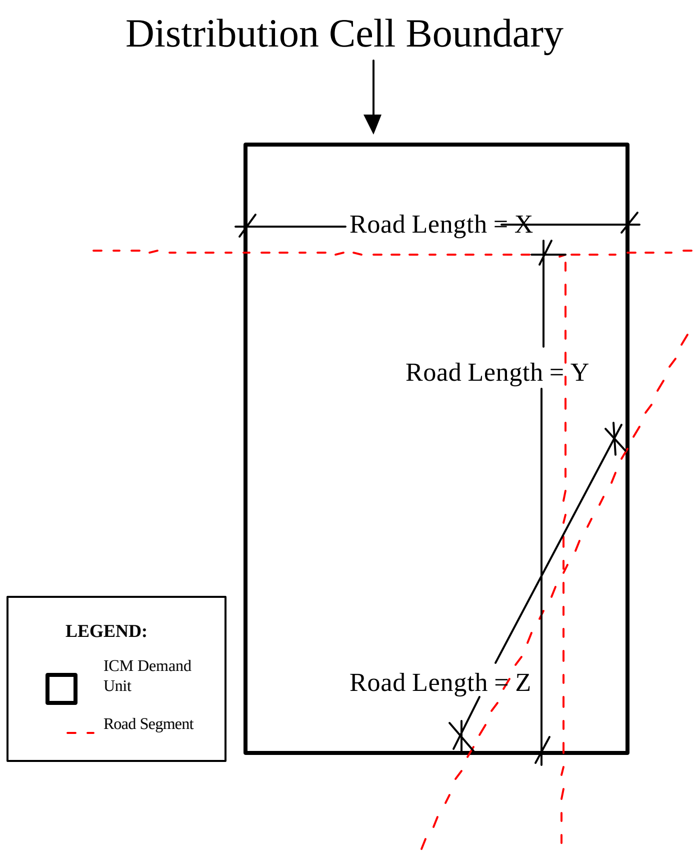


Stopwatch Maps extracts all road/street sections except limited access highways and their ramps and other minor categories of roads from the Tiger files into a MapInfo table for counties served by Verizon. Limited access highways and their ramps are excluded because it is extremely unlikely that a house would be located along that type of road. Stopwatch Maps then overlays, through MapInfo, the relevant demand unit network upon this table, calculating the total length of road sections in demand unit.

The diagram below depicts three road segments within one demand unit. The sum of each identified road segment is assigned to the demand unit. This sample demand unit would result in a road length assignment of:

x + y + z = total demand unit road length in feet

This calculation takes into account the length of curved and straight sections of road, but does not account for the distance required to go up and down hills. The resulting sum is rounded to a whole number.



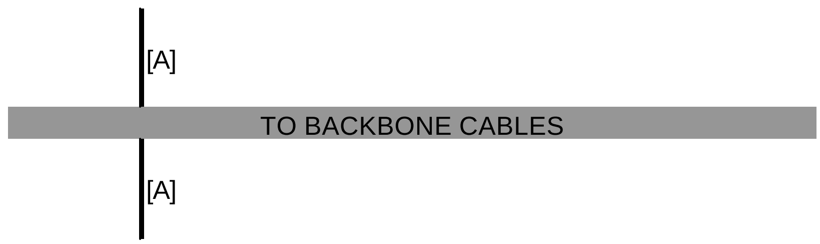
The intention of the terrain development data process is to determine the overall surface character of any given demand unit, in order to better evaluate the potential costs involved in providing telephone service. The data utilized to support this process originates from the US Department of Agriculture, the State Soil Geographic Data Base (STATSGO), previously processed to produce the Stopwatch Maps product *State Terrain by Demand unit*, which was directly used in this effort.

Stopwatch Maps programmatically overlays the previously generated demand unit network and the terrain table. Bedrock Depth and Water Table Depth that vary within the area of a demand unit are averaged and assigned appropriately.

Appendix C: Distribution Styles & Distribution Diagrams

The following pages contain the nine distribution diagrams (or stick maps) that are currently used in ICM in the development of distribution investments. These diagrams/templates cover varied levels of demand and show how one can generate distribution diagrams of various shapes and sizes. These diagrams, however, are just pointers. A user may devise his/her own diagrams depending on his/her demand database and specific requirements.

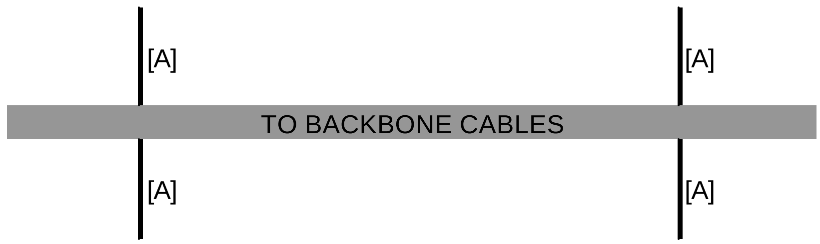
Stick Map for Distribution Style One



In Distribution Style One, the backbone cables have two spans. Both the spans support only itself. Hence, in this case, both the spans are labeled as “A”.

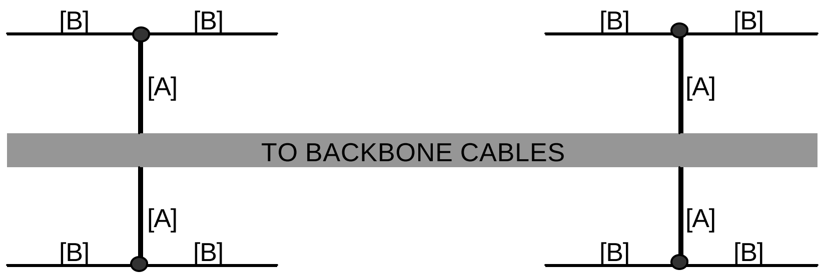
In all the nine distribution diagrams, the spans are labeled in ascending order – the span that supports the most number of spans is labeled “A” and so forth. Also, n*ote that the value of each span label is specific to that particular diagram.* For instance, in Distribution Style Three and above, a span labeled “A“ support additional spans plus itself whereas in the Distribution Style One and the Distribution Style Two, the span labeled “A” supports only itself. In these two distribution styles, there are no span(s), other than span “A”, coming out of the backbone cables to support.

Stick Map for Distribution Style Two



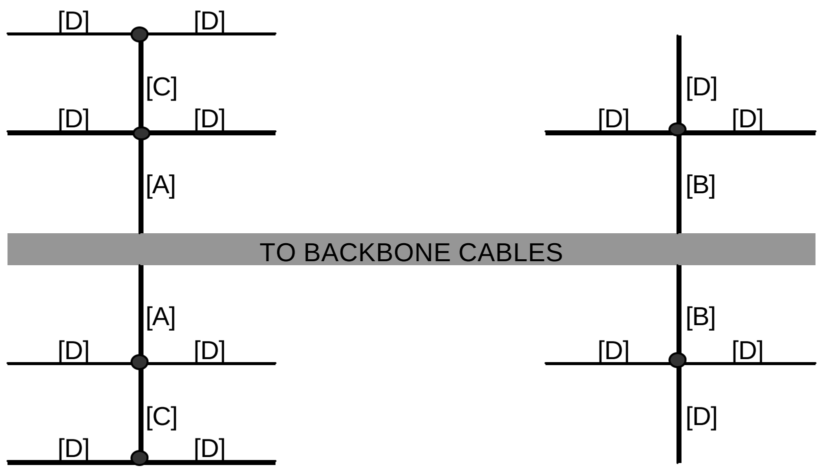
The Distribution Style Two is almost similar to the Distribution Style One with the exception that in this case instead of two spans coming out of the backbone cables, there are four spans. However, since all the spans support only itself, they are at the same demand level and are labeled “A”.

Stick Map for Distribution Style Three



The Distribution Style Three is different from the two earlier styles. This time, the span labeled "A" supports two other spans including itself and the span labeled "B" support only itself. The distribution design is symmetrical within each side and between the two sides.

Stick Map for Distribution Style Four

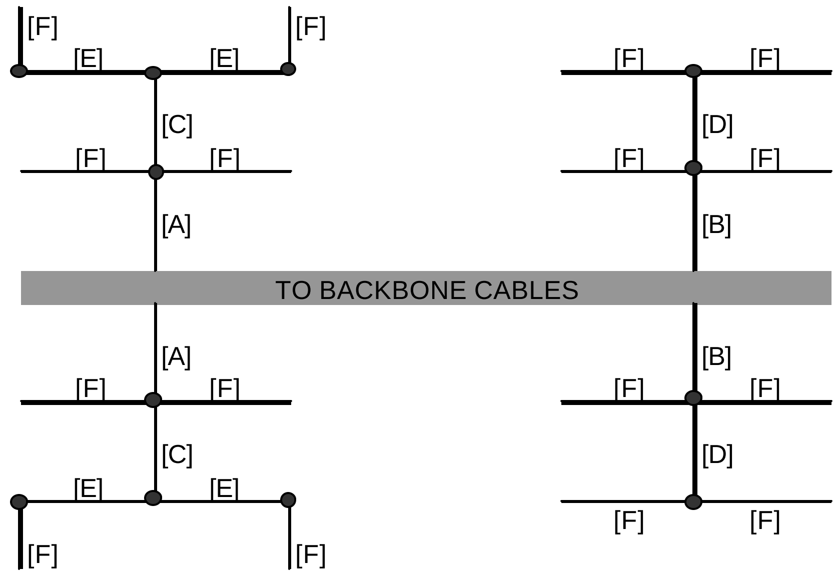


The Distribution Style Four shows an asymmetry of design between two sides and symmetry of design within each side. The first thing to notice here is that, unlike earlier distribution styles, the first span coming out of the backbone cables are labeled different.

On the right side of the backbone cables, the first span coming out of the backbone cables is labeled “B”, whereas on the left side the cables the first span is labeled “A”. The difference in labeling conveys different number of spans the span labeled “A” and the span labeled “B” supports – the span labeled “A” supports five spans plus itself and the span labeled “B” supports three spans plus itself.

Similarly, the span labeled “D” supports only itself and the span labeled “C” supports two spans plus itself.

Stick Map for Distribution Style Five

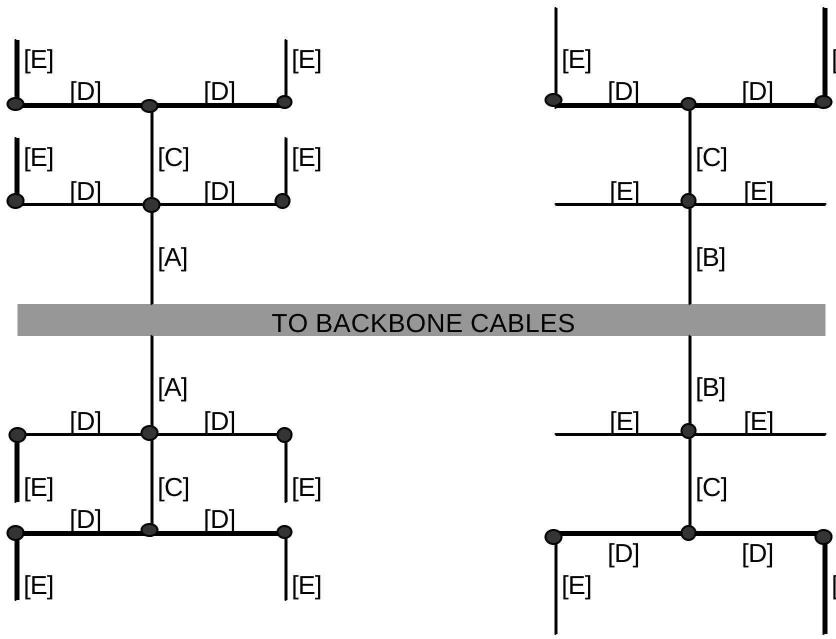


The Distribution Style Five is another example of a diagram that shows an asymmetry of design between the two sides of the backbone cables and symmetry of design within each side of the cable. In this case, the span labeled “A” supports seven spans plus itself and the span labeled “B” supports five spans plus itself. Whereas the span labeled “C” supports four spans plus itself, the span labeled “D” supports two spans plus itself.

Notice that unlike the case in the right side of the diagram, there is no span labeled “B” on the left side of the diagram. This is because, there is no span on the left side of the diagram that supports exactly five spans plus itself. In this diagram, the span labeled “B” is assigned to a span which supports exactly five spans plus itself.

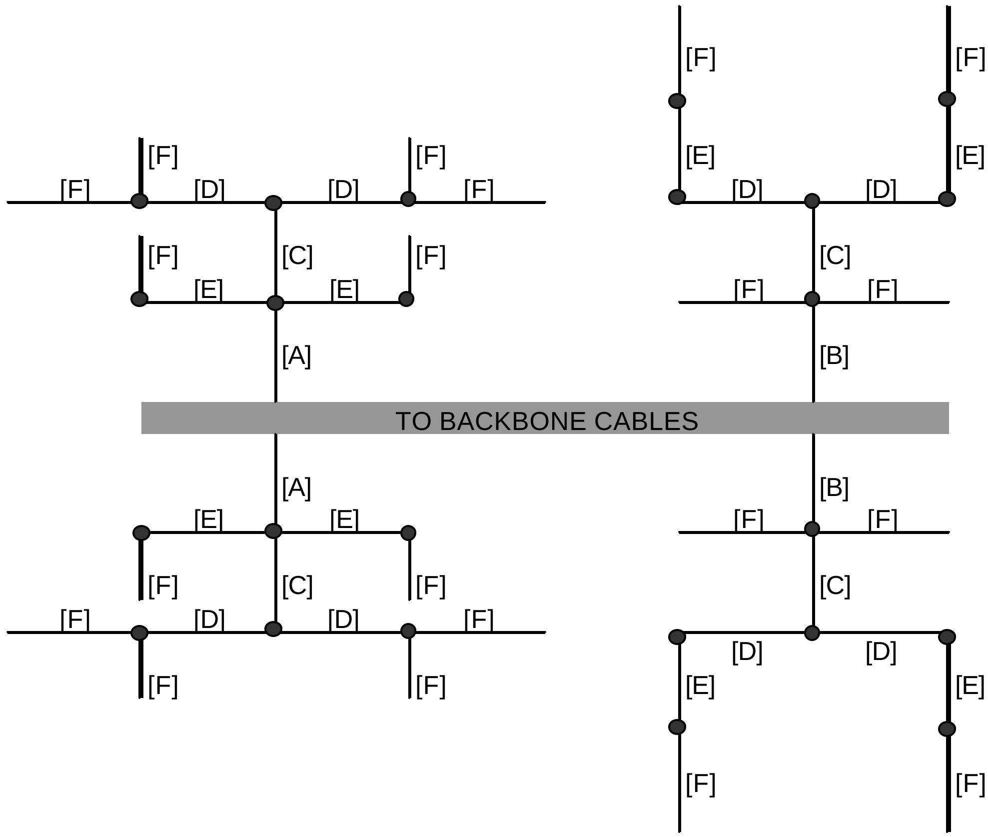
Again, note that the value of each span label is specific to that particular diagram. For instance, the span labeled “B’ in the Distribution Style Five is supporting exactly five spans plus itself. However, the span labeled “B” in the Distribution Style Six is supporting exactly seven spans plus itself. The values of these two spans labeled, as “B”, is different because each supports different number of spans.

Stick Map for Distribution Style Six



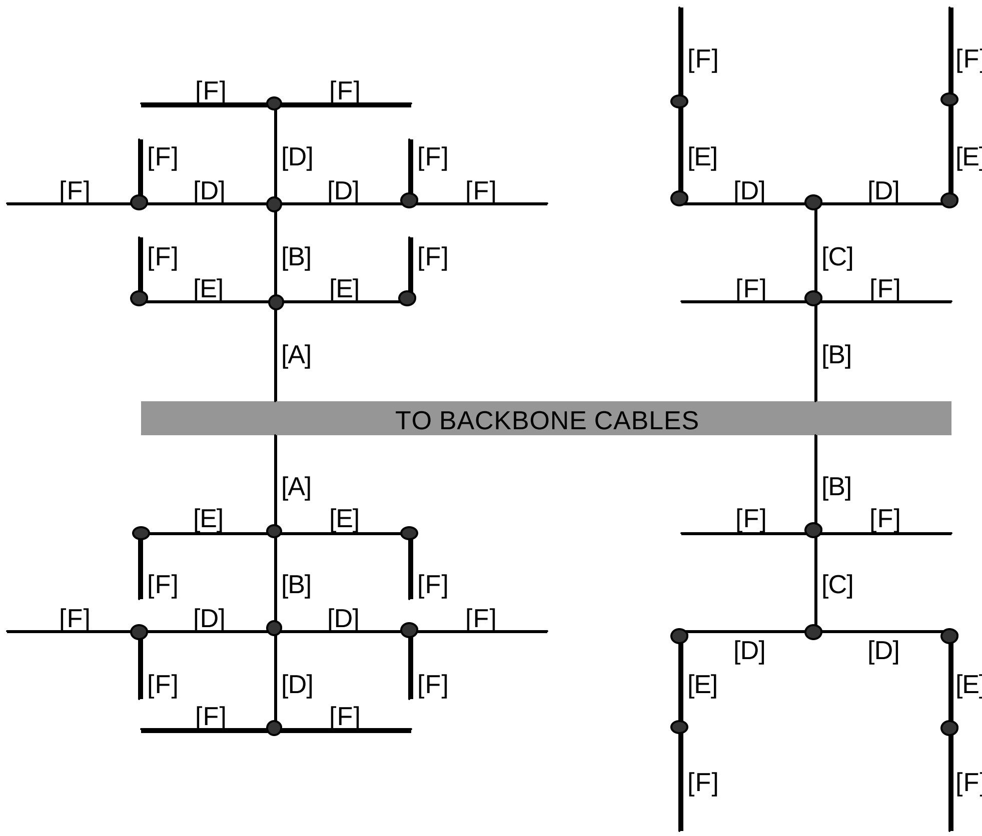
The Distribution Style Six is yet another example of a diagram that shows an asymmetry of design between two sides of the backbone cables and symmetry of design within each side. In this case, the span labeled “A” supports the highest number of spans, nine spans plus itself and the span labeled “E” supports the lowest number of spans, only itself. Whereas the span labeled “D” supports one other span plus itself, the span labeled “C” supports four other spans plus itself. Notice that unlike the case in the right side of the diagram, there is no span labeled “B” on the left side of the diagram. This is because, there is no span on the left side of the diagram that supports exactly seven spans plus itself. In this diagram, the span label “B” is assigned to a span that supports seven spans plus itself.

Stick Map for Distribution Style Seven



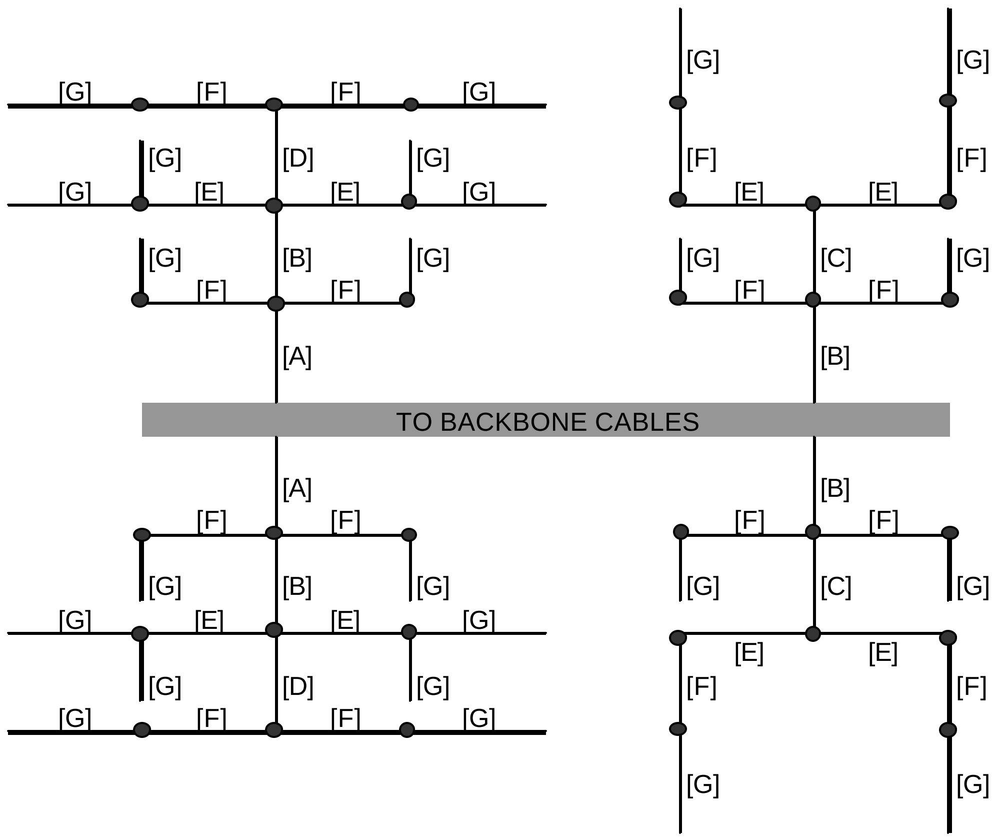
The Distribution Style Seven is yet another example of a diagram that shows an asymmetry of design between two sides of the backbone cables and symmetry of design within each side. As in all other cases, in this case too, the span labeled “A” supports the highest number of spans, eleven spans plus itself. Also, in this diagram, the span labeled “F” supports the lowest number of spans, only itself. Similarly, the span labeled “D” supports two other spans including itself and the span labeled “C” supports six other spans including itself. Notice that there is no span labeled “B” on the left side of the diagram. Again, this is the case because there is no span on the left side of the diagram that supports exactly nine spans plus itself.

Stick Map for Distribution Style Eight



The Distribution Style Eight has symmetry of design within each side the backbone cables and asymmetry of design between the two sides of the cables. In this diagram, the span labeled “A” supports thirteen spans plus itself and the span labeled “B” supports nine spans plus itself. The span labeled “F” supports the lowest number of spans, only itself.

Stick Map for Distribution Style Nine



The Distribution Style Nine has symmetry of design within each side of the backbone cables and asymmetry of design between the two sides of the cables. In this diagram, the span labeled “A” supports sixteen spans plus itself, and the span labeled “G” supports the lowest number of spans, only itself.

The nine distribution diagrams show several ways in which a user may design a distribution network. Depending on his/her data set, a user may use any one of the nine diagrams presented here, or any combination of them, to design his/her own network.

Appendix D: Loop Components

The Loop Components comprise of two parts: Feeder and Distribution. ICM deploys copper feeder cable for shorter loops and fiber feeder cable with Next Generation Digital Loop Carrier (NGDLC) for longer loops. The fiber feeder cables extend from the wire center out to a remote terminal. In the remote terminal, the NGDLC converts optical signals to electrical signals. The electrical signals then travel over copper distribution cables and drop wires to the end user's location.

The Figure 8 below identifies the feeder and distribution portions of loop and its components. The top drawing shows a copper loop with aerial distribution cable. The bottom drawing shows a fiber/copper loop that is all buried. A detail description of Distribution and Feeder components is provided following Figure 8.

The manner in which distribution and feeder cables are placed determines the support structure required. For instance, aerial cable is supported by poles, buried cable is placed in trenches, and underground cable requires conduit, manholes and pull boxes.

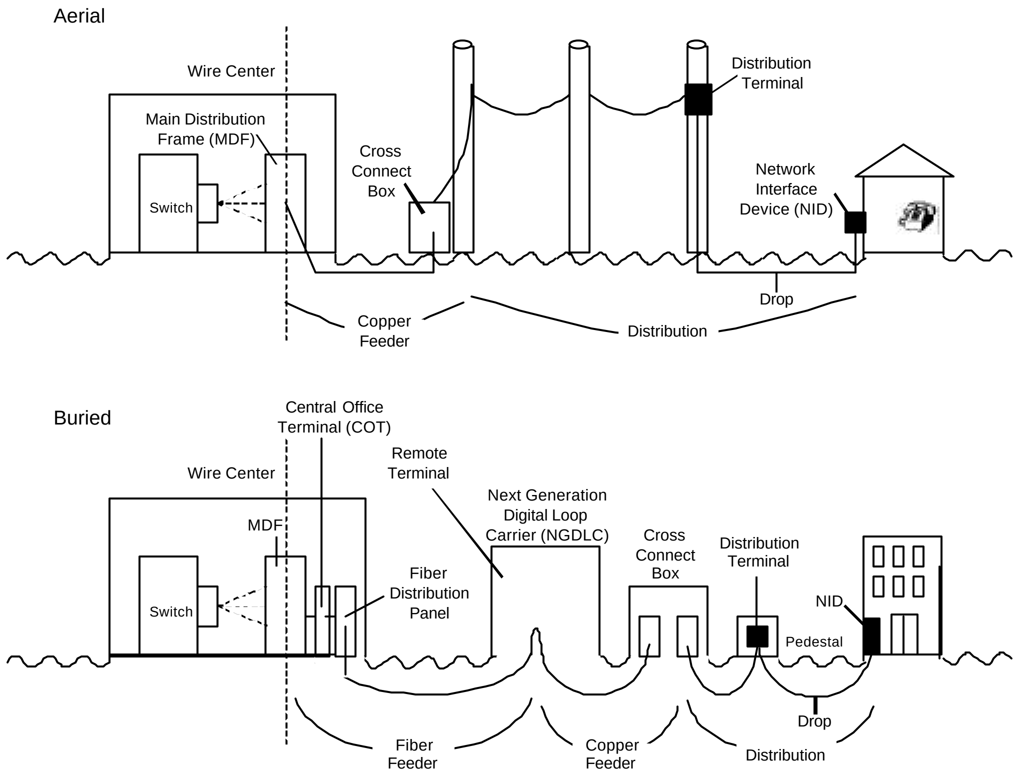


Figure 8: Aerial Copper and Buried Fiber/Copper Loops

Distribution Components

Distribution consists of the network components from the end-user's location up to, but not including, the cross connect box. The major components for distribution are listed below:

- **Network Interface Device (NID)** is the loop component that serves as the interface between the drop wire and the end user's inside wiring. The NID may be located inside or outside the end user's premises.
- **Drop Wire** for both residence and business is the loop component used to transport telephone service from the distribution terminal to the end user's NID. The drop wire is assumed to be buried copper cable.
- **Distribution Terminal** is the loop component that serves as the cross connect point between the distribution cable and the drop wire. The distribution terminal may be connected to

buried cable and located in a pedestal, or connected to aerial cable and mounted on a pole or building.

- **Distribution Cable** is the loop component used to transport telephone service from the cross connect box to the distribution terminal near the end-user's location. Distribution cable consists of copper cable and can be buried, underground, or aerial.

Feeder Components

Feeder consists of the network components from the cross connect box to the wire center. At the wire center, the copper feeder cables terminate on the Main Distribution Frame (MDF). The fiber optic feeder cables terminate on the Fiber Distribution Panel before extending to the Central Office Terminal (COT). The major components for feeder are listed below:

- **Cross Connect Box** is the loop component that serves as the connecting point between distribution and feeder.
- **Next Generation Digital Loop Carrier (NGDLC) or Pair Gain System** is the currently available technology required to accommodate fiber optic cable. When fiber feeder is used, the NGDLC is located in a Remote Terminal (RT) adjacent to the Cross-Connect Box and in the wire center in a COT.
- **Feeder Cable** is the loop component that transports telephone service via a copper cable from the Main Distribution Frame or DLC remote terminal to a cross connect box, or via a fiber cable from a DLC Central Office Terminal to a DLC Remote terminal. Feeder cable may be buried, underground, or aerial.
- **MDF Protector** is a protection device spliced to the end of the copper feeder cables and mounted on the Main Distribution Frame. It serves as a lightning suppresser to protect the switch.
- **Main Distribution Frame (MDF)** is a metallic frame used to mount the protectors spliced to the outside plant cables on one side and the connecting blocks, for terminating jumper cables to the switch and other central office equipment, on the other side. It serves as the interface between the loop and the switch.
- **Fiber Distribution Panel** is the termination point for fiber cable where the individual fibers are split apart and then extended to the COT.

For investment calculation purposes, the vertical side of the MDF and all of the MDF protectors are considered part of the loop. The horizontal side of the MDF is considered part of the switch.

Appendix E: Identifying the Number and Composition of ESAs Using the K-Mean Algoritym in ICM

Background Information

The K-mean clustering algorithm, along with associated processing routines, is used in ICM to determine the number and composition of the Electronic Serving Areas (ESAs) in a wire center. The "K" in "K-mean" refers to the number of ESAs (also called clusters below), while the "mean" refers to the center of gravity of each ESA or cluster.

One can think of an ESA as a collection or cluster of demand points. If the demand points are represented by balls of equal mass embedded in a uniform plane with zero thickness, then the center of gravity (the mean of the cluster) is the point at which the plane would balance. Note that this center or mean may correspond to a location that has no demand. Cluster zero corresponds to the core area; its center is the switch location and its membership is determined by satisfying a restriction on copper loop length. (Within ICM, this restriction is either 12 or 18 kilofeet.) The K-mean algorithm is used to determine the location and membership of the remaining clusters, which correspond to ESAs with one or more DLCs located at its center.

Note that if all of the demand points fall within the core area, then there is no need for DLCs, and the identification of clusters outside of the core does not take place. Also, the description below is designed to convey the logic underlying ICM's use of the K-mean algorithm to identify the number and composition of the ESAs within a wire center. Consequently, certain bookkeeping tasks (such as keeping track of the number of demand points in a cluster that fail the copper loop length description) are not described.

How the K-Mean Algorithm Works

The objective of the K-mean algorithm is to divide a set of points into K clusters such that each point is assigned to the cluster whose center is closest to it. The algorithm is recursive in nature, since the composition of the clusters and the set of means changes with each round of assignments.

Given an arbitrary candidate set of K means, each point is assigned to the mean in this set that is closest to it. This assignment defines a set of K clusters, each with a center of gravity. These K centers of gravity become the new candidate set of K means, and the assignment process is repeated. The algorithm is completed when the new candidate set of K means is the same as the prior set.

The algorithm itself requires that a value of K be specified in advance, and has no provision for changing this value. However, as explained below, ICM's use of the K-mean algorithm will increase or decrease the value of K in order to insure that the copper loop length restriction is sufficiently satisfied, and to insure that the initial value of K has not been set too high.

How ICM Uses the K-Mean Algorithm

ICM's use of the K-mean algorithm is outlined as a 12-step process in Attachment A. In the first step, cluster zero (the core area) is identified based on the restriction specified by the user for copper loop length. Demand points assigned to the core area are excluded from membership in the remaining K clusters. Steps (2) and (3) determine the initial value for K and the initial arbitrary candidate set for the K means. Because the core area is generally the densest area of the wire center it will usually have the greatest number of demand points assigned to it. Consequently, dividing the total number of demand points in the wire center by the number of demand points in core produces an initial value of K that is likely to be too low with respect to the copper loop length restriction.

Steps (4), (5) and (6) represent the K-mean algorithm. Given the current candidate set of means, demand points are assigned to clusters based on their distance relative to each mean. The centers of the resulting clusters define a new candidate set of means. If the new candidate set is different than the prior set, the assignment process is repeated, producing another candidate set of means. If the two sets are the same, the K-mean algorithm is exited and ICM adjusts K in order to insure that the copper loop length restriction is satisfied and to insure that K has not been set too high.

Whether or not the copper loop length restriction has been satisfactorily met is defined in terms of the proportion of demand points that meet the loop length restriction.[11] This proportion is calculated in Step (7). If the proportion is less

[11] As explained below, ICM deems the loop length restriction to be satisfactorily met if less than 2 percent of the demand points fail to meet it for the wire center overall and if no more than 50 percent

than 0.98 – indicating that more than 2 percent of the demand points fail to meet the copper loop length restriction – then the value of K is increased by one and a new candidate mean is arbitrarily selected from the cluster that has the greatest number of demand points that do not meet the restriction. (See Steps (8) and (11).) Processing of the K-mean algorithm begins again at Step (4), with the prior candidate set of means plus this arbitrarily selected mean used as the new candidate set of means.

Once the proportion of demand points satisfying the loop length restriction equals or exceeds 0.98, ICM checks to see if more than 50 percent of the demand points in any cluster fails to meet the copper loop length restriction. (See Steps (9) and (10).) If this condition holds, then the value of K is increased by 1 and a new candidate mean is arbitrarily chosen from the cluster identified in Step (9). Checking for this condition identifies clusters which significantly fail the loop length restriction even though the condition is satisfactorily met for the wire center overall. The prior set of means, along with the arbitrarily chosen mean, form a new candidate set of means and processing of the K-mean algorithm begins again at Step (4).

If the proportion of demand points meeting the loop length restriction is equal to or greater than 0.98 for the wire center overall and is also greater than 0.50 for each cluster individually, then ICM checks to see if K has ever been increased from its initial value. (See Steps (9) and (12).) If K has not been increased, ICM decreases it by 1 and arbitrarily drops one of the means from the candidate set of means; processing of the K-mean algorithm begins again at Step (4). This check detects situations in which the initial value of K has been set too high. Note that K will continue to be decreased until it is increased at either Step (10) or (11). Processing stops once this has occurred, provided that the proportion of demand points meeting the loop length restriction is equal to or greater than 0.98 for the wire center overall and is also greater than 0.50 for each cluster individually.

of the demand points in any given cluster fail to meet it. A zero failure rate is not specified in order to avoid over placement of DLCs.

Outline of ICM's Use of the K-Mean Algorithm in ICM

(1) Identify the core area based on the specified copper loop-length restriction; demand units in the core areas are excluded from the remaining clusters.

(2) Decide on an initial value for K. In ICM, the initial value is determined by dividing the total number of demand units in the wire center by the number of demand units in the core area, and truncating this result to an integer value.

(3) Arbitrarily pick the first set of K means. In ICM, the demand points in a wire center are stored in an array. For example, if there were 1,000 demand points and if K equaled 5, then every 200^{th} demand point is selected as one of the initial K means.

(4) Determine cluster membership by assigning each demand unit to the mean closest to it.

(5) Calculate a new set of means (centers of gravity) for the clusters determined in (4). This becomes the new candidate set of K means.

(6) If the new candidate set is the same as the prior candidate set, go to step (7) below; otherwise go to step (4) above, using the new candidate set of means.

(7) For the clusters returned from step (6), calculate the proportion of demand units in the wire center that meet the copper loop length restriction. Let this proportion be represented by "R" in what follows.

(8) If $R < 0.98$, go to step (11) below.

(9) If $R \geq 0.98$, check to see if more than 50 percent of the demand units in any cluster fails to meet the copper loop length restriction. If the answer is "Yes", go to step (10) below; otherwise go to step (12) below.

(10) Increment K by one and arbitrarily select a demand point from the cluster identified in step (9) to be a new candidate mean. ICM arbitrarily selects the new candidate mean as the first demand point in the identified cluster in the array that stores the demand point locations. Go to step (4) above, using the new candidate set of means.

(11) Find the cluster with the greatest number of demand points not satisfying the copper loop length restriction. As in step (10) above, increment K by one and arbitrarily select a demand point from this cluster to be the new candidate mean. Go to step (4) above, using the new candidate set of means.

(12) If K has not been increased up to this point, decrease it by one and drop an arbitrary member of the last set of candidate means and go to step (4) above. ICM arbitrarily drops the last mean in the array that stores their locations. If K has been increased prior to this point, exit the algorithm – determination of the number and composition of the ESAs is complete.